

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LICENSED TRANSMITTER

Test Report No. : OT-189-RWD-011
AGR No. : A187A-244
Applicant : Suntech International Ltd.
Address : (Gasam-dong, Greatvally), B-1506, 32, Digital-ro9-gil, Geumchon-gu, Seoul, Korea
Manufacturer : Suntech International Ltd.
Address : (Gasam-dong, Greatvally), B-1506, 32, Digital-ro9-gil, Geumchon-gu, Seoul, Korea
Type of Equipment : Personal & Asset Tracker
FCC ID. : WA2ST3940
Model Name : ST3940
Serial number : N/A
Total page of Report : 77 pages (including this page)
Date of Incoming : July 16, 2018
Date of issue : September 05, 2018

SUMMARY

The equipment complies with the regulation; **FCC Part 22 Subpart H, Part 24 Subpart E**

This test report only contains the result of a single test of the sample supplied for the examination.

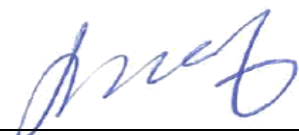
It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:



Jae-Ho Lee / Chief Engineer
ONETECH Corp.

Approved by:



Keun-Young, Choi / Vice President
ONETECH Corp.

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
OT-189-RWD-011	September 05, 2018	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : Suntech International Ltd.
 Address : (Gasam-dong, Greatvally), B-1506, 32, Digital-ro9-gil, Geumchon-gu, Seoul, Korea
 Contact Person : Wilson Oh / General Manager
 Telephone No. : +82-2-6327-5656
 FCC ID : WA2ST3940
 Model Name : ST3940
 Serial Number : N/A
 Date : September 05, 2018

EQUIPMENT CLASS	PCB-PCS Licensed Transmitter
EQUIPMENT DESCRIPTION	Personal & Asset Tracker
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI/TIA-603-D-2010
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC Part 22 Subpart H, Part 24 Subpart E
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
2.1049	Occupied Bandwidth	Met the Limit / PASS
2.1051, 22.917(a), 24.238(a)	Band Edge / Spurious and Harmonic Emissions at Antenna Termianl	Met the Limit / PASS
2.1046	Conducted Output Power	Met the Limit / PASS
24.232(d)	Peak-to-Average Ratio	Met the Limit / PASS
2.1055, 22.355	Frequency stability / Variation of ambient temperature	Met the Limit / PASS
24.235		Met the Limit / PASS
22.913(a)(2)	Effective Radiated Power Equivalent Isotropic Radiated Power	Met the Limit / PASS
24.232(c)	Equivalent Isotropic Radiated Power	Met the Limit / PASS
2.1053, 22.917(a), 24.238(a)	Radiated Spurious and Harmonic Emissions	Met the Limit / PASS

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC Part 22 Subpart H, Part 24 Subpart E.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI/TIA-603-D-2010. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666 / T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The Suntech International Ltd., Model ST3940 (referred to as the EUT in this report) is a Personal & Asset Tracker. Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	Personal & Asset Tracker		
OPERATING FREQUENCY	GSM850	TX	824.2 MHz ~ 848.8 MHz
		RX	869.2 MHz ~ 893.8 MHz
	GSM1900	TX	1 850.2 MHz ~1 909.8 MHz
		RX	1 930.2 MHz ~ 1 989.8 MHz
	WCDMA Band 5	TX	826.4 MHz ~ 846.6 MHz
		RX	871.4 MHz ~ 891.6 MHz
	WCDMA Band 2	TX	1 852.4 MHz ~ 1 907.6 MHz
		RX	1 932.4 MHz ~ 1 987.6 MHz
MAX. RF OUTPUT POWER	GSM850	31.61 dBm	
	GSM1900	29.34 dBm	
	WCDMA Band 5	21.95 dBm	
	WCDMA Band 2	22.30 dBm	
Effective Radiated Power	GSM850	28.16 dBm	
	WCDMA Band 5	18.17 dBm	
Equivalent Isotropic Radiated Power	GSM1900	28.57 dBm	
	WCDMA Band 2	21.50 dBm	
ANTENNA TYPE	Internal Antenna		
ANTENNA GAIN	GSM850 / WCDMA Band 5	-3.48 dBi	
	GSM1900 / WCDMA Band 2	-1.18 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	26 MHz		

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	N/A	N/A	N/A
Battery	YUILSYSTEM	PD1711	N/A
Antenna	N/A	N/A	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
N/A	N/A	N/A	N/A

5.3 Mode of operation during the test

The EUT was received signal form signal generator and then each modulation was configured for maximum signal gain and bandwidth. The EUT was operated in a manner representative of the typical usage of the equipment. During all testing, system components were manipulated within the confines of typical usage to maximize each emission. The applicant does not supply antenna(s) with the system, so the dummy loads were connected to the RF output ports on the EUT for radiated spurious emission testing.

For the above testing, following frequencies per channel were selected for each modulation.

- Mode

Modulation	Channel	Frequency
GSM850	Low	824.2
	Middle	836.6
	High	848.8
GSM1900	Low	1 850.2
	Middle	1 880.0
	High	1 909.8
WCDMA Band 5	Low	826.4
	Middle	835.0
	High	846.6
WCDMA Band 2	Low	1 852.4
	Middle	1 880.0
	High	1 907.6

5.4 Configuration of Test System

Line Conducted Test: The EUT is connected wirelessly through the Communication Unit. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. CONDUCTED OUTPUT POWER

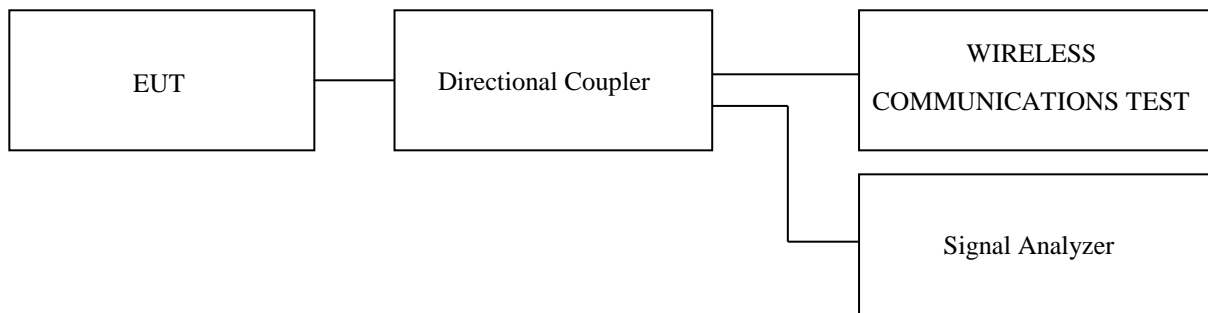
7.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

7.2 Test set-up

Conducted Output Power is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 5.2.

A base station simulator was used to establish communication with the EUT, and Spectrum analyzer was used for test results. This device was tested under all configurations and the highest power is reported. Conducted Output Powers of EUT are reported below.



7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)
■ -	CMW500	Rohde & Schwarz	WIDEBAND RADIO COMMUNICATION TESTER	127298	Mar. 15, 2018 (1Y)
■ -	Directional Coupler	AA-MCS	AAMCS-UDC	400	Aug. 23, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

7.4 Test data

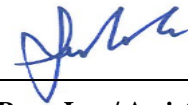
-. Test Date : July 16, 2018 ~ August 14, 2018

-. Test Result : Pass

BAND	CHANNEL	GSM (dBm)	GPRS (dBm)	EGPRS (dBm)
GSM850	Low	31.61	31.58	31.55
	Middle	31.54	31.52	31.48
	High	31.56	31.53	31.50
GSM1900	Low	29.33	28.84	28.88
	Middle	29.34	28.87	28.91
	High	29.30	28.82	28.85

BAND	CHANNEL	RMC (dBm)	HSDPA (dBm)	HSUPA (dBm)
WCDMA Band 5	Low	21.95	21.63	21.58
	Middle	21.72	21.44	21.40
	High	21.61	21.29	21.26
WCDMA Band 2	Low	22.28	22.15	22.08
	Middle	22.30	22.16	22.09
	High	22.26	22.12	22.06

This test was measured by setting as worst case.



Tested by: **Ha-Ram, Lee** / Assistant Manager

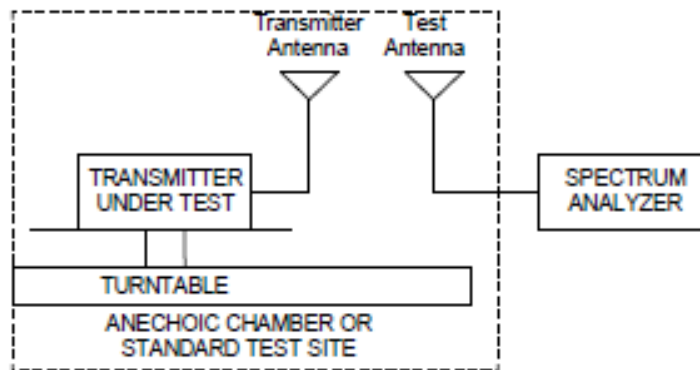
8. EFFECTIVE RADIATED POWER

8.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

8.2 Test set-up

The EUT and measurement equipment were set up as shown in the diagram below.



8.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
□ - ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 27, 2017 (1Y)
■ - ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 27, 2017 (1Y)
■ - 310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 28, 2018 (1Y)
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)
■ - BBV9718B	Schwarzbeck	Broadband Preamplifier	009	Mar. 16, 2018 (1Y)
□ - SCU-18	Rohde & Schwarz	Pre-Amplifier	102346	Oct. 24, 2017 (1Y)
■ - MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509	N/A
□ - HD100	HD GmbH	Position Controller	N/A	N/A
■ - DT3000-3t	Innco Systems GmbH	Turn Table	N/A	N/A
□ - FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	Jun 05, 2018 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jul. 28, 2017 (2Y)
□ - SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Apr. 04, 2017 (1Y)
■ - CMW500	Rohde & Schwarz	WIDEBAND RADIO COMMUNICATION TESTER	127298	Mar. 15, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

8.4 Test data for GSM850

-. Test Date : July 16, 2018 ~ August 14, 2018

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBd)	ERP (dBm)	Limits (dBm)	Margin (dB)
Test Data for GSM850							
824.2	14.25	H	1.75	5.35	17.85	38.45	20.60
824.2	24.56	V	1.75	5.35	28.16	38.45	10.29
836.6	14.25	H	1.76	5.25	17.74	38.45	20.71
836.6	24.60	V	1.76	5.25	28.09	38.45	10.36
848.8	14.62	H	1.77	5.05	17.90	38.45	20.55
848.8	24.83	V	1.77	5.05	28.11	38.45	10.34

Remark: GSM850 is measured the highest power mode.

“H”: Horizontal, “V”: Vertical

8.5 Test data for WCDMA Band 5

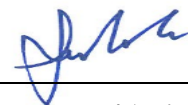
-. Test Date : July 16, 2018 ~ August 14, 2018

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBd)	ERP (dBm)	Limits (dBm)	Margin (dB)
Test Data for WCDMA Band 5							
826.4	4.86	H	1.75	5.35	8.46	38.45	24.54
826.4	14.57	V	1.75	5.35	18.17	38.45	14.83
835.0	4.74	H	1.76	5.25	8.23	38.45	24.77
835.0	14.64	V	1.76	5.25	18.13	38.45	14.87
846.6	5.09	H	1.77	5.05	8.37	38.45	24.63
846.6	14.80	V	1.77	5.05	18.08	38.45	14.92

Remark: WCDMA Band 5 is measured the highest power mode.

“H”: Horizontal, “V”: Vertical



Tested by: Ha-Ram, Lee / Assistant Manager

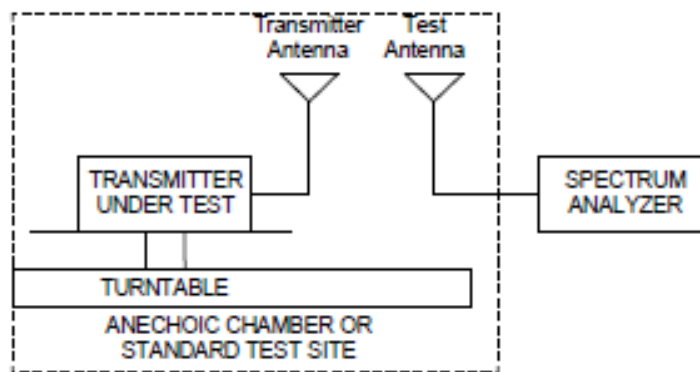
9. EQUIVALENT ISOTROPIC RADIATED POWER

9.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

9.2 Test set-up

The EUT and measurement equipment were set up as shown in the diagram below.



9.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
<input type="checkbox"/> - ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 27, 2017 (1Y)
<input checked="" type="checkbox"/> - ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 27, 2017 (1Y)
<input checked="" type="checkbox"/> - 310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 28, 2018 (1Y)
<input checked="" type="checkbox"/> - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)
<input checked="" type="checkbox"/> - BBV9718B	Schwarzbeck	Broadband Preamplifier	009	Mar. 16, 2018 (1Y)
<input checked="" type="checkbox"/> - SCU-03	Rohde & Schwarz	Signal Conditioning Unit	100333	Mar. 15, 2018 (1Y)
<input type="checkbox"/> - SCU-18	Rohde & Schwarz	Pre-Amplifier	102346	Oct. 24, 2017 (1Y)
<input checked="" type="checkbox"/> - MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509	N/A
<input type="checkbox"/> - HD100	HD GmbH	Position Controller	N/A	N/A
<input checked="" type="checkbox"/> - DT3000-3t	Innco Systems GmbH	Turn Table	N/A	N/A
<input type="checkbox"/> - FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
<input checked="" type="checkbox"/> - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	Jun 05, 2018 (2Y)
<input checked="" type="checkbox"/> - VULB9163	Schwarzbeck	Hybrid Antenna	777	Apr, 13, 2018 (2Y)
<input checked="" type="checkbox"/> - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
<input checked="" type="checkbox"/> - BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jul. 28, 2017 (2Y)
<input type="checkbox"/> - SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Apr. 04, 2017 (1Y)
<input checked="" type="checkbox"/> - CMW500	Rohde & Schwarz	Wideband Radio Communication Tester	127298	Mar. 15, 2018 (1Y)
<input type="checkbox"/> - ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 27, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

9.4 Test data for GSM1900

-. Test Date : July 16, 2018 ~ August 14, 2018

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
Test Data for GSM1900							
1 850.2	11.95	H	2.67	6.50	15.78	33.00	17.22
1 850.2	24.74	V	2.67	6.50	28.57	33.00	4.43
1 880.0	11.97	H	2.71	6.40	15.66	33.00	17.34
1 880.0	24.83	V	2.71	6.40	28.52	33.00	4.48
1 909.8	13.76	H	2.73	6.70	15.73	33.00	17.27
1 909.8	24.59	V	2.73	6.70	28.56	33.00	4.44

Remark: GSM1900 is measured the highest power mode.

“H”: Horizontal, “V”: Vertical

9.5 Test data for WCDMA Band 2

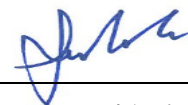
-. Test Date : July 16, 2018 ~ August 14, 2018

-. Test Result : Pass

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	EIRP (dBm)	Limits (dBm)	Margin (dB)
Test Data for WCDMA Band 2							
1 852.4	4.53	H	2.67	6.50	8.36	33.00	24.64
1 852.4	17.62	V	2.67	6.50	21.45	33.00	11.55
1 880.0	4.71	H	2.71	6.40	8.40	33.00	24.60
1 880.0	17.81	V	2.71	6.40	21.50	33.00	11.50
1 907.6	4.42	H	2.73	6.70	8.39	33.00	24.61
1 907.6	17.47	V	2.73	6.70	21.44	33.00	11.56

Remark: WCDMA Band 2 is measured the highest power mode.

“H”: Horizontal, “V”: Vertical



Tested by: Ha-Ram, Lee / Assistant Manager

10. RADIATED SPURIOUS EMISSIONS

10.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

10.2 Test set-up

Radiated emission measurements are performed in the Semi-Anechoic chamber. The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA- 603-D-2010 Clause 2.2.17. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the level of the maximized emission. The level and position of the maximized emission is recorded with the spectrum analyzer using RMS detector. A vertically polarized half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The power is calculated by the following formula;

$$Pd(\text{dBm}) = Pg(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

Where: Pd is the dipole equivalent power and Pg is the generator output power into the substitution antenna.

The maximum EIRP is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration

Radiated spurious emissions

1. Frequency Range : 9 kHz ~ 10th Harmonics of highest channel fundamental frequency.
2. The EUT was setup to maximum output power. The 100 kHz RBW was used to scan from 30 MHz to 1 GHz. Also, the 1 MHz RBW was used to scan from 1 GHz to 10 GHz(GSM850) or 20 GHz(GSM1900). The high, low and a middle channel were tested for out of band measurements.

10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
<input type="checkbox"/>	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 27, 2017 (1Y)
<input checked="" type="checkbox"/>	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 27, 2017 (1Y)
<input checked="" type="checkbox"/>	310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 28, 2018 (1Y)
<input checked="" type="checkbox"/>	SCU-03	Rohde & Schwarz	Signal Conditioning Unit	100333	Mar. 15, 2018 (1Y)
<input checked="" type="checkbox"/>	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)
<input checked="" type="checkbox"/>	BBV9718B	Schwarzbeck	Broadband Preamplifier	009	Mar. 16, 2018 (1Y)
<input checked="" type="checkbox"/>	SCU-18	Rohde & Schwarz	Pre-Amplifier	102346	Oct. 24, 2017 (1Y)
<input checked="" type="checkbox"/>	MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509	N/A
<input type="checkbox"/>	HD100	HD GmbH	Position Controller	N/A	N/A
<input checked="" type="checkbox"/>	DT3000-3t	Innco Systems GmbH	Turn Table	N/A	N/A
<input type="checkbox"/>	FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
<input checked="" type="checkbox"/>	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	Jun 05, 2018 (2Y)
<input checked="" type="checkbox"/>	VULB9163	Schwarzbeck	Hybrid Antenna	777	Apr, 13, 2018 (2Y)
<input checked="" type="checkbox"/>	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
<input checked="" type="checkbox"/>	BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jul. 28, 2017 (2Y)
<input type="checkbox"/>	SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Apr. 04, 2017 (1Y)
<input checked="" type="checkbox"/>	CMW500	Rohde & Schwarz	Wideband Radio Communication Tester	127298	Mar. 15, 2018 (1Y)
<input type="checkbox"/>	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 27, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

10.4 Test data

10.4.1 Test data for GSM850


- . Test Date : July 16, 2018 ~ August 14, 2018
- . Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 3 MHz for Peak Mode and Average Mode
300 kHz for Peak Mode for the emissions outside restricted band
- . Detector : Max Hold
- . Measurement distance : 3 m
- . Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
1 648.40	-49.02	H	2.48	7.20	-44.30	-13.00	31.30
1 648.40	-58.66	V	2.48	7.20	-53.94	-13.00	40.94
2 472.60	-42.46	H	3.15	5.70	-39.91	-13.00	26.91
2 472.60	-50.71	V	3.15	5.70	-48.16	-13.00	35.16
Test Data for Middle Channel							
1 673.20	-52.45	H	2.49	7.50	-47.44	-13.00	34.44
1 673.20	-60.91	V	2.49	7.50	-55.90	-13.00	42.90
2 509.80	-45.06	H	3.18	5.80	-42.44	-13.00	29.44
2 509.80	-51.99	V	3.18	5.80	-49.37	-13.00	36.37
Test Data for High Channel							
1 697.60	-55.03	H	2.54	7.40	-50.17	-13.00	37.17
1 697.60	-60.62	V	2.54	7.40	-55.76	-13.00	42.76
2 546.40	-47.88	H	3.22	5.60	-45.50	-13.00	32.50
2 546.40	-47.75	V	3.22	5.60	-45.37	-13.00	32.37

Remark: Measured Output Power : 31.61 dBm (1.45 W) Limit : 43+10log(W)

Limit : 31.61 - 43+10log(1.45) = -13 dBm

“C.L” : Cable Loss, “H”: Horizontal, “V”: Vertical



Tested by: Ha-Ram, Lee / Assistant Manager

10.4.2 Test data for GSM1900

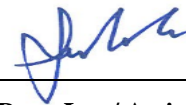
- . Test Date : July 16, 2018 ~ August 14, 2018
- . Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 3 MHz for Peak Mode and Average Mode
300 kHz for Peak Mode for the emissions outside restricted band
- . Detector : Max Hold
- . Measurement distance : 3 m
- . Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 700.40	-84.77	H	3.94	12.46	-76.25	-13.00	63.25
3 700.40	-82.74	V	3.94	12.46	-74.22	-13.00	61.22
5 550.60	-81.39	H	4.86	12.92	-73.33	-13.00	60.33
5 550.60	-81.24	V	4.86	12.92	-73.18	-13.00	60.18
Test Data for Middle Channel							
3 760.00	-85.42	H	3.96	12.46	-76.92	-13.00	63.92
3 760.00	-83.27	V	3.96	12.46	-74.77	-13.00	61.77
5 640.00	-81.54	H	4.92	12.92	-73.54	-13.00	60.54
5 640.00	-81.22	V	4.92	12.92	-73.22	-13.00	60.22
Test Data for High Channel							
3 819.60	-84.58	H	4.01	12.46	-76.13	-13.00	63.13
3 819.60	-82.33	V	4.01	12.46	-73.88	-13.00	60.88
5 729.40	-81.42	H	4.97	12.92	-73.47	-13.00	60.47
5 729.40	-81.20	V	4.97	12.92	-73.25	-13.00	60.25

Remark: Measured Output Power : 29.34 dBm (0.86 W) Limit : 43+10log(W)

Limit : 29.34 - 43+10log(0.86) = -13 dBm

“C.L” : Cable Loss, “H”: Horizontal, “V”: Vertical



Tested by: Ha-Ram, Lee / Assistant Manager

10.4.3 Test data for WCDMA Band 5

- Test Date : July 16, 2018 ~ August 14, 2018
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 3 MHz for Peak Mode and Average Mode
300 kHz for Peak Mode for the emissions outside restricted band
- Detector : Max Hold
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
1 652.80	-60.83	H	2.48	7.20	-56.11	-13.00	43.11
1 652.80	-56.95	V	2.48	7.20	-52.23	-13.00	39.23
2 479.20	-51.22	H	3.16	5.70	-48.67	-13.00	35.67
2 479.20	-49.30	V	3.16	5.70	-46.75	-13.00	33.75
Test Data for Middle Channel							
1 670.00	-61.85	H	2.48	7.50	-56.84	-13.00	43.84
1 670.00	-58.13	V	2.48	7.50	-53.12	-13.00	40.12
2 505.00	-49.40	H	3.17	5.80	-46.78	-13.00	33.78
2 505.00	-50.53	V	3.17	5.80	-47.91	-13.00	34.91
Test Data for High Channel							
1 693.20	-60.78	H	2.52	7.40	-55.92	-13.00	42.92
1 693.20	-57.55	V	2.52	7.40	-52.69	-13.00	39.69
2 539.80	-48.71	H	3.20	5.60	-46.33	-13.00	33.33
2 539.80	-49.59	V	3.20	5.60	-47.21	-13.00	34.21

Remark: Measured Output Power : 21.95 dBm (0.16 W) Limit : 43+10log(W)

Limit : 21.95 - 43+10log(0.16) = -13 dBm

“C.L” : Cable Loss, “H”: Horizontal, “V”: Vertical



Tested by: Ha-Ram, Lee / Assistant Manager

10.4.4 Test data for WCDMA Band 2

- . Test Date : July 16, 2018 ~ August 14, 2018
- . Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 3 MHz for Peak Mode and Average Mode
300 kHz for Peak Mode for the emissions outside restricted band
- . Detector : Max Hold
- . Measurement distance : 3 m
- . Result : PASSED

Frequency (MHz)	Substituted Level (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Ant Gain (dBi)	Corrected Reading (dBm)	Limits (dBm)	Margin (dB)
Test Data for Low Channel							
3 704.80	-85.14	H	3.94	12.46	-76.62	-13.00	63.62
3 704.80	-85.69	V	3.94	12.46	-77.17	-13.00	64.17
5 557.40	-81.46	H	4.88	12.92	-73.42	-13.00	60.42
5 557.40	-81.32	V	4.88	12.92	-73.28	-13.00	60.28
Test Data for Middle Channel							
3 760.00	-85.67	H	3.96	12.46	-77.17	-13.00	64.17
3 760.00	-84.26	V	3.96	12.46	-75.76	-13.00	62.76
5 640.00	-81.65	H	4.92	12.92	-73.65	-13.00	60.65
5 640.00	-81.47	V	4.92	12.92	-73.47	-13.00	60.47
Test Data for High Channel							
3 815.20	-84.81	H	3.98	12.46	-76.33	-13.00	63.33
3 815.20	-84.59	V	3.98	12.46	-76.11	-13.00	63.11
5 722.80	-81.46	H	4.95	12.92	-73.49	-13.00	60.49
5 722.80	-81.28	V	4.95	12.92	-73.31	-13.00	60.31

Remark: Measured Output Power : 22.30 dBm (0.17 W) Limit : 43+10log(W)

Limit : 22.30 - 43+10log(0.17) = -13 dBm

“C.L” : Cable Loss, “H”: Horizontal, “V”: Vertical



Tested by: Ha-Ram, Lee / Assistant Manager

11. PEAK-TO-AVERAGE RATIO

11.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

11.2 Test set-up

Peak to Average Power Ratio is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 5.7.

- Section 5.7.2 Measurement of peak power in a broadband noise-like signal using CCDF

- a) Set resolution/measurement bandwidth \geq OBW or specified reference bandwidth.
- b) Set the number of counts to a value that stabilizes the measured CCDF curve.
- c) Set the measurement interval as follows:
 - 1) For continuous transmissions, set to the greater of $[10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ or 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. Set the measurement interval to a time that is less than or equal to the burst duration.
 - 3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
- d) Record the maximum PAPR level associated with a probability of 0.1%.
- e) The peak power level is calculated from the sum of the PAPR value from step d) to the measured average power.

- Section 5.7.3 Alternate Procedure for PAPR

Some regulatory requirements specify a PAPR limit when the output power limits are specified in terms of average power. If it becomes necessary to provide measurement data to demonstrate compliance to a PAPR limit, then the appropriate procedure from those provided in 5.2.3 shall be utilized to determine the peak power (or peak PSD) and the appropriate procedure from those provided in 5.2.4 shall be used to determine the average power (or average PSD). The data from these measurements is then used in Equation (2) to determine the PAPR of a narrowband CW-like signal. See 5.2.3.4 for guidance on determining the PAPR of a broadband noise-like signal.

$$\text{PAPR (dB)} = P_{\text{Pk}} \text{ (dBm or dBW)} - P_{\text{Avg}} \text{ (dBm or dBW)}$$

where

PAPR peak-to-average power ratio, in dB

P_{Pk} measured peak power or peak PSD level, in dBm or dBW

P_{Avg} measured average power or average PSD level, in dBm or dBW

11.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)
■ - CMW500	Rohde & Schwarz	WIDEBAND RADIO COMMUNICATION TESTER	127298	Mar. 15, 2018 (1Y)
■ - Directional Coupler	AA-MCS	AAMCS-UDC	400	Aug. 23, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

11.4 Test data

- Test Date : July 16, 2018 ~ August 14, 2018

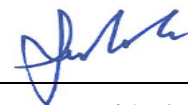
- Test Result : Pass

Band	Channel	Measured P _{pk} (dBm)	Measured P _{av} (dBm)	Peak-Average Ratio(PAR)	Limit (dB)	Result
GSM850	128	31.61	31.53	0.08	13.00	PASS
	190	31.54	31.48	0.06	13.00	PASS
	251	31.56	31.49	0.07	13.00	PASS
GSM1900	512	29.33	29.29	0.04	13.00	PASS
	661	29.34	29.31	0.03	13.00	PASS
	810	29.30	29.27	0.03	13.00	PASS

Remark: PAPR (dB) = P_{pk} (dBm or dBW) – P_{AvG} (dBm or dBW)

Band	Channel	Peak-Average Ratio(PAR) CCDF 0.1 %	Limit (dB)	Result
WCDMA Band 5	4132	2.70	13.00	PASS
	4175	2.64	13.00	PASS
	4233	2.75	13.00	PASS
WCDMA Band 2	9262	2.67	13.00	PASS
	9400	2.67	13.00	PASS
	9538	2.61	13.00	PASS

Remark: Measured the using CCDF of spectrum analyzer.



Tested by: Ha-Ram, Lee / Assistant Manager

12. OCCUPIED BANDWIDTH

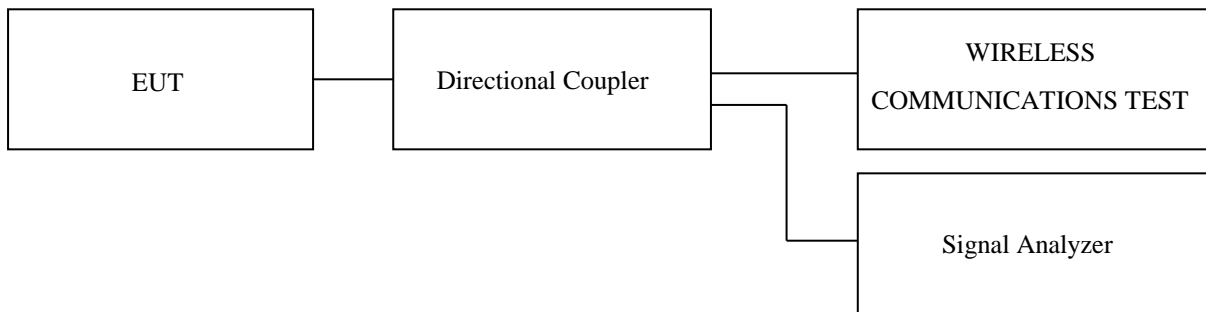
12.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

12.2 Test set-up

The emission bandwidth (×dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated × dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3× the resolution bandwidth. When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3×RBW.



12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)
■ -	CMW500	Rohde & Schwarz	WIDEBAND RADIO COMMUNICATION TESTER	127298	Mar. 15, 2018 (1Y)
■ -	Directional Coupler	AA-MCS	AAMCS-UDC	400	Aug. 23, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

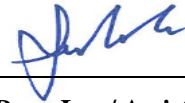
12.4 Test data

12.4.1 Test data for GSM850

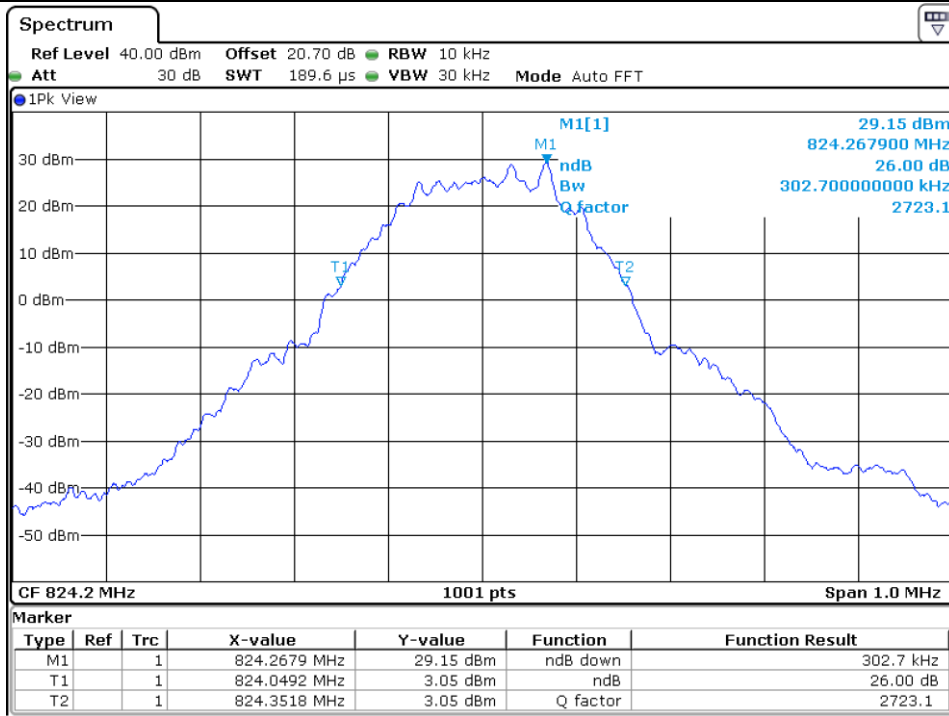
-. Test Date : July 16, 2018 ~ August 14, 2018

-. Test Result : Pass

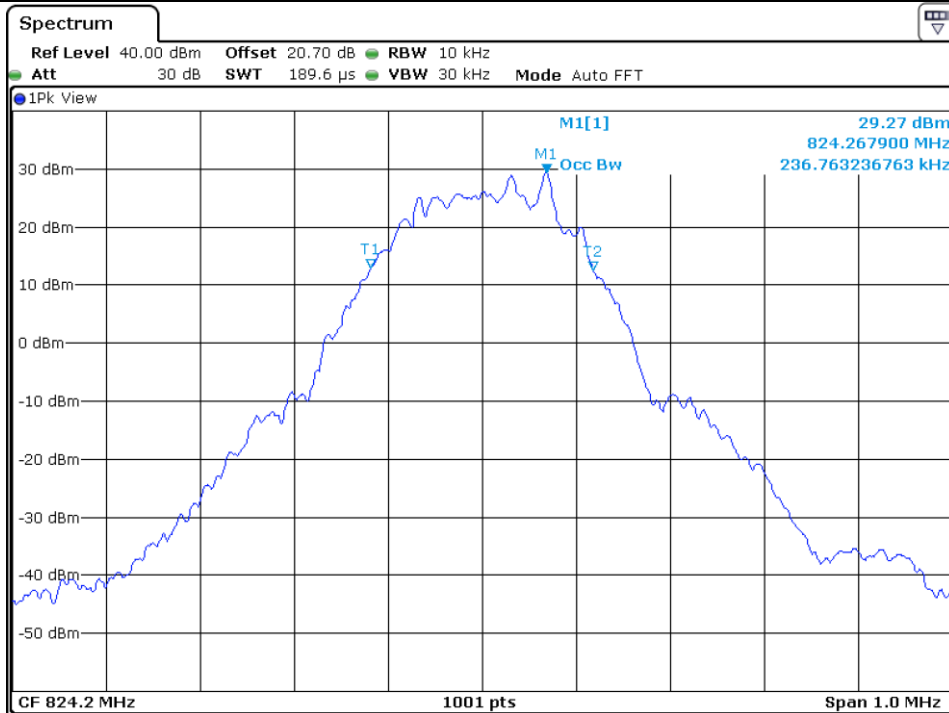
Band	Channel	26 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)	Result
GSM850	Low	302.70	236.76	PASS
	Middle	303.70	237.76	PASS
	High	304.70	237.76	PASS



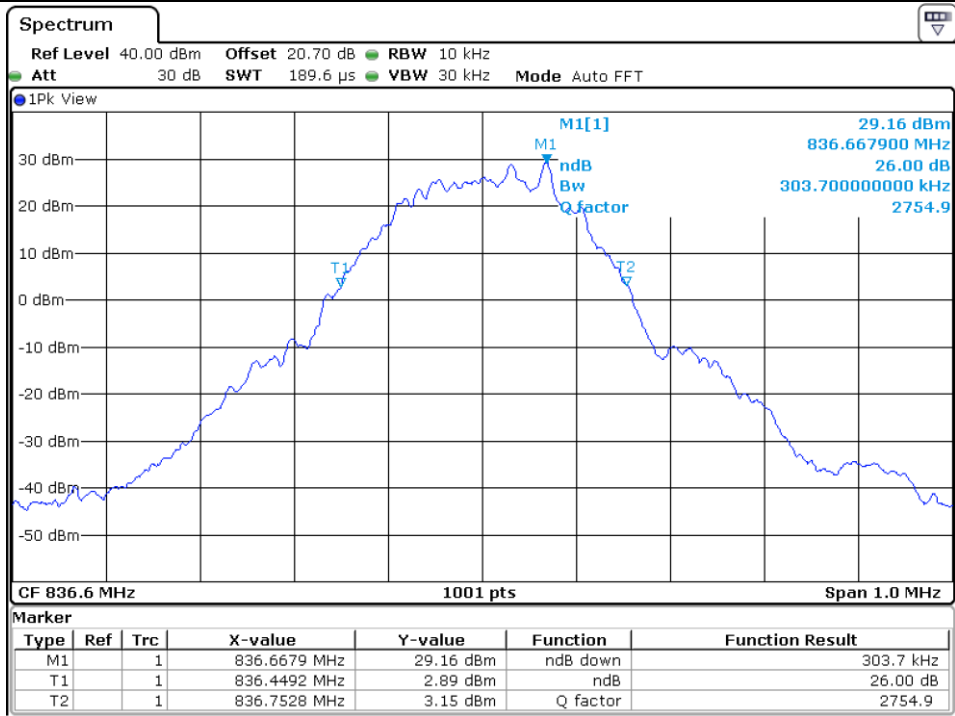
Tested by: Ha-Ram, Lee / Assistant Manager



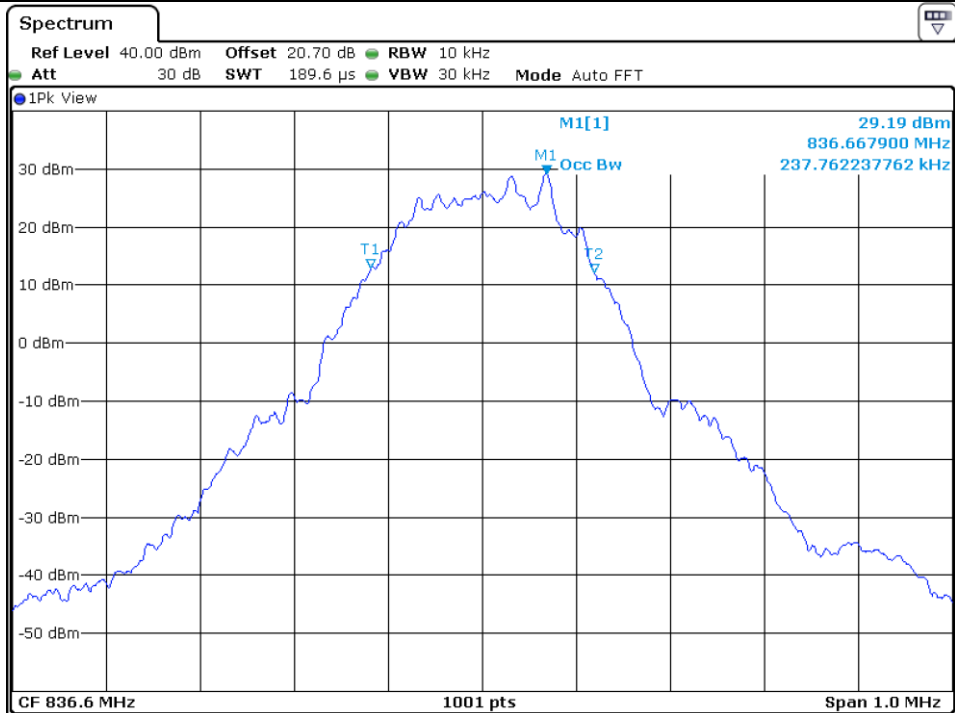
Low Channel (26 dB Bandwidth)



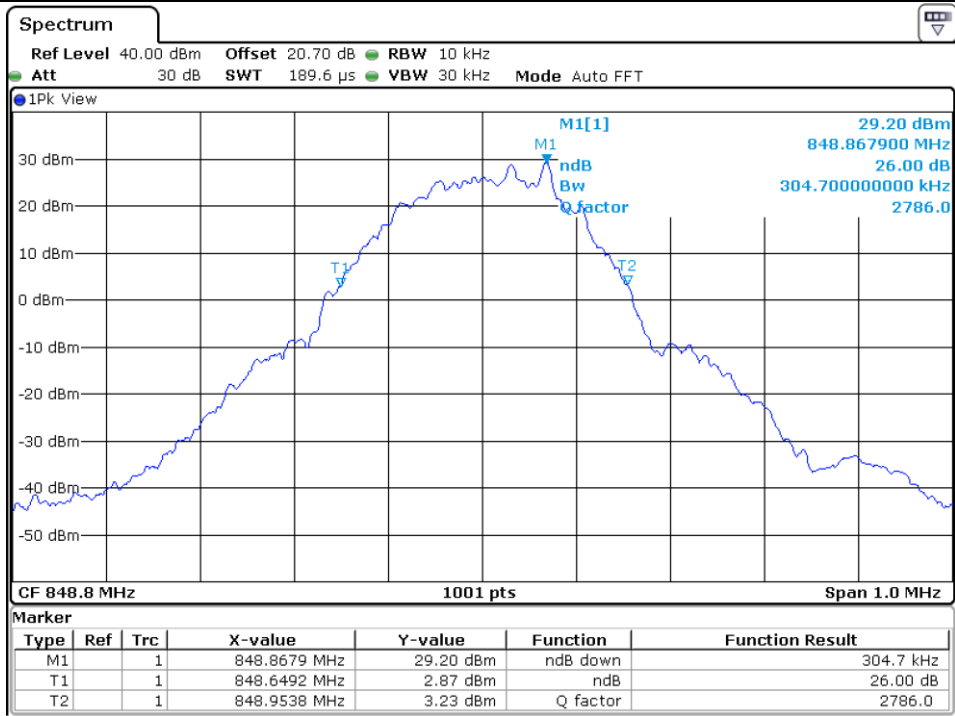
Low Channel (99 % Occupied Bandwidth)



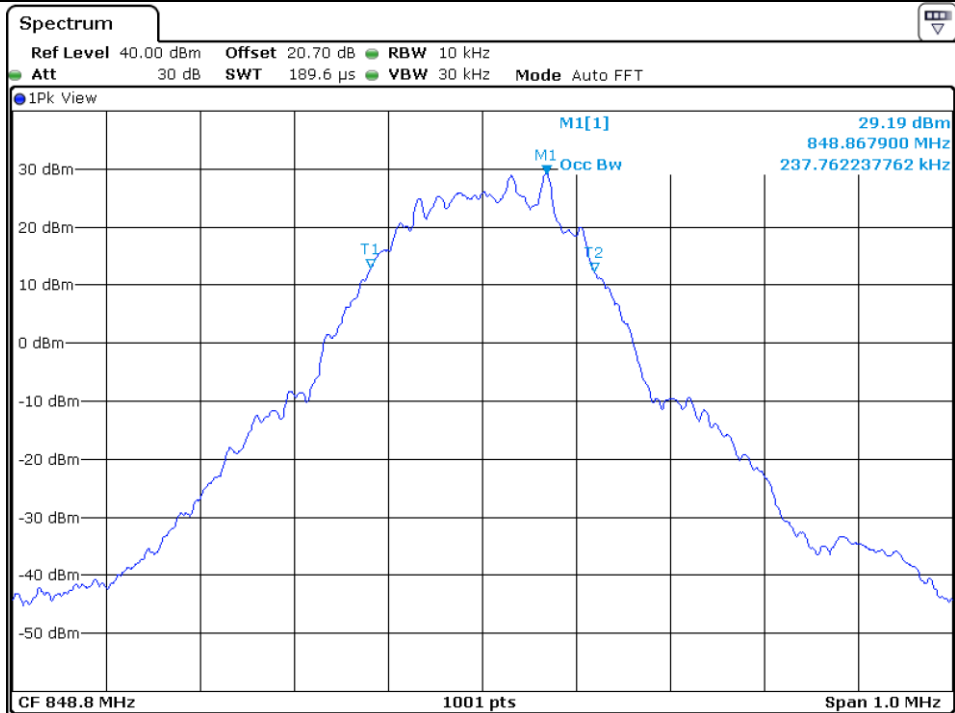
Middle Channel (26 dB Bandwidth)



Middle Channel (99 % Occupied Bandwidth)



High Channel (26 dB Bandwidth)




High Channel (99 % Occupied Bandwidth)

12.4.2 Test data for GSM1900

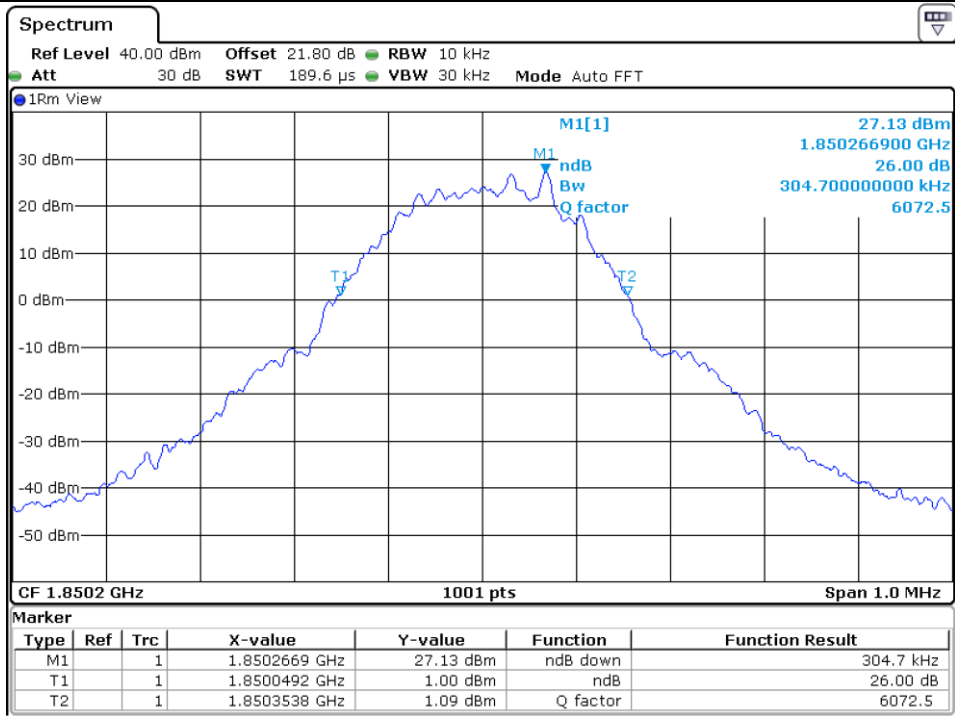
-. Test Date : July 16, 2018 ~ August 14, 2018

-. Test Result : Pass

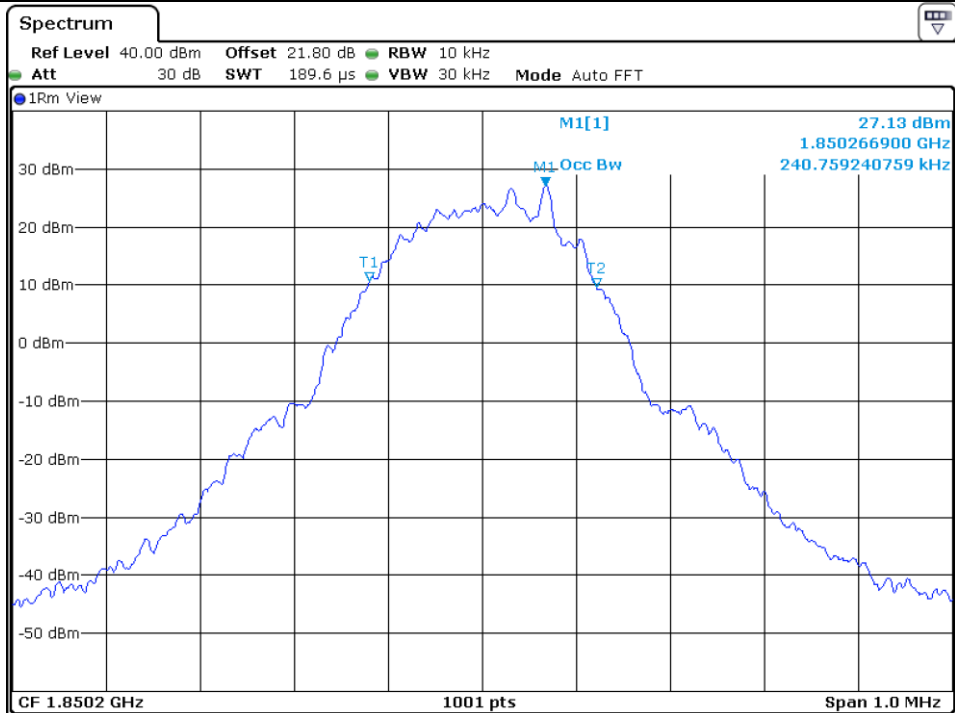
Band	Channel	26 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)	Result
GSM1900	Low	304.70	240.76	PASS
	Middle	306.70	241.76	PASS
	High	306.70	239.76	PASS



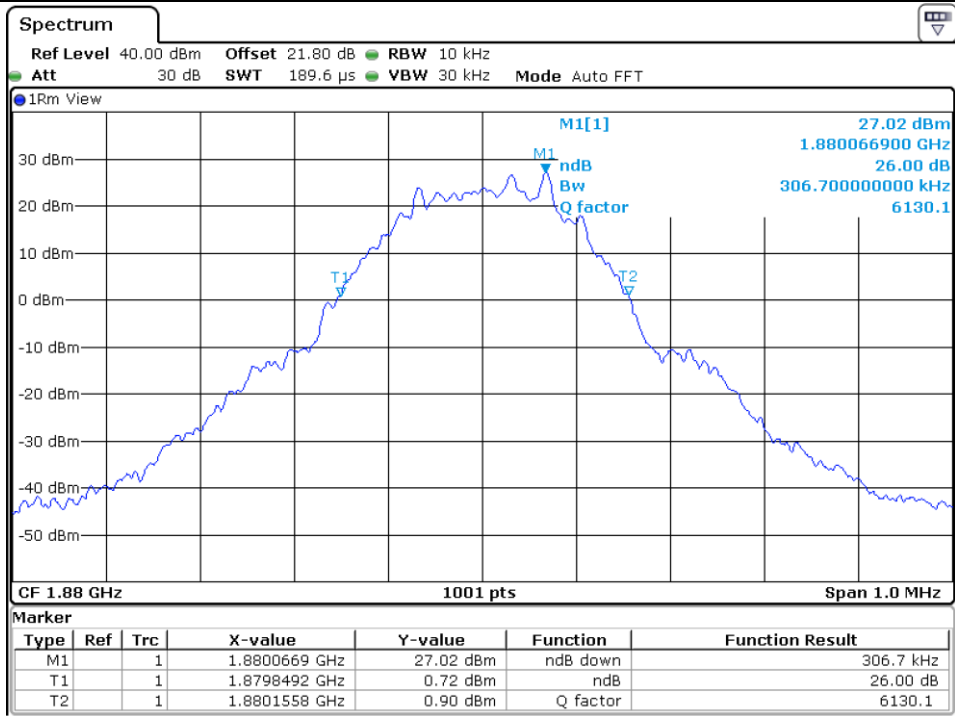
Tested by: Ha-Ram, Lee / Assistant Manager



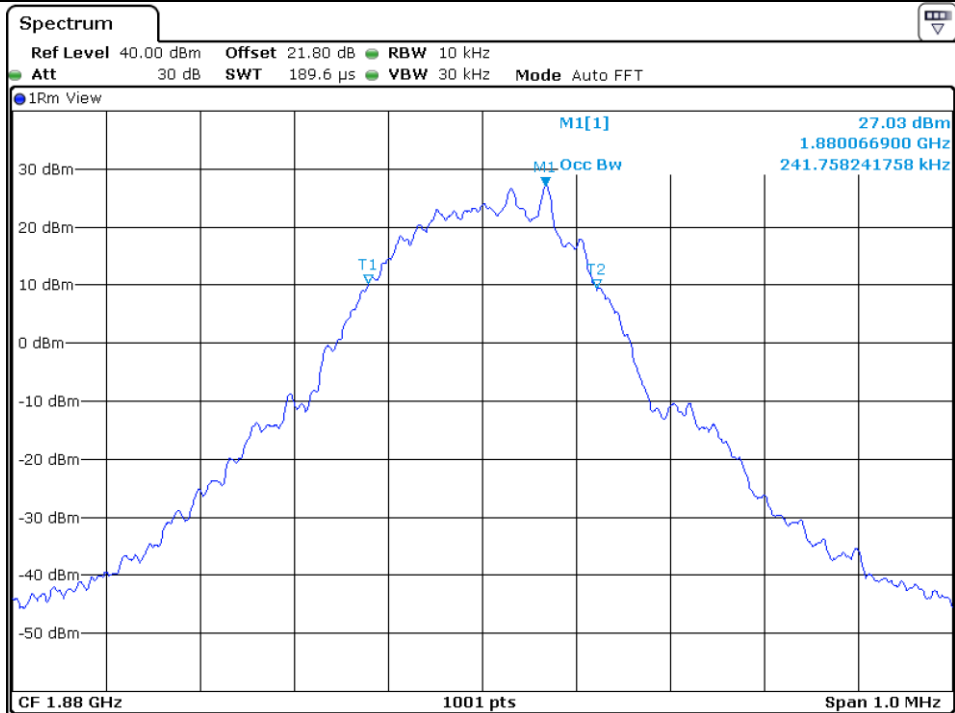
Low Channel (26 dB Bandwidth)



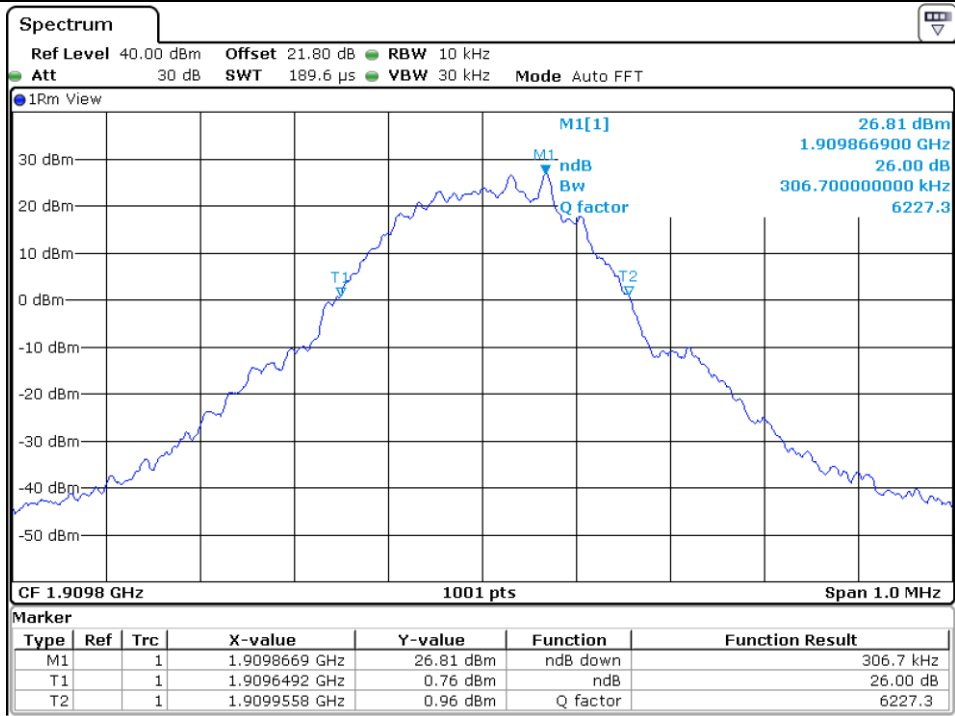
Low Channel (99 % Occupied Bandwidth)



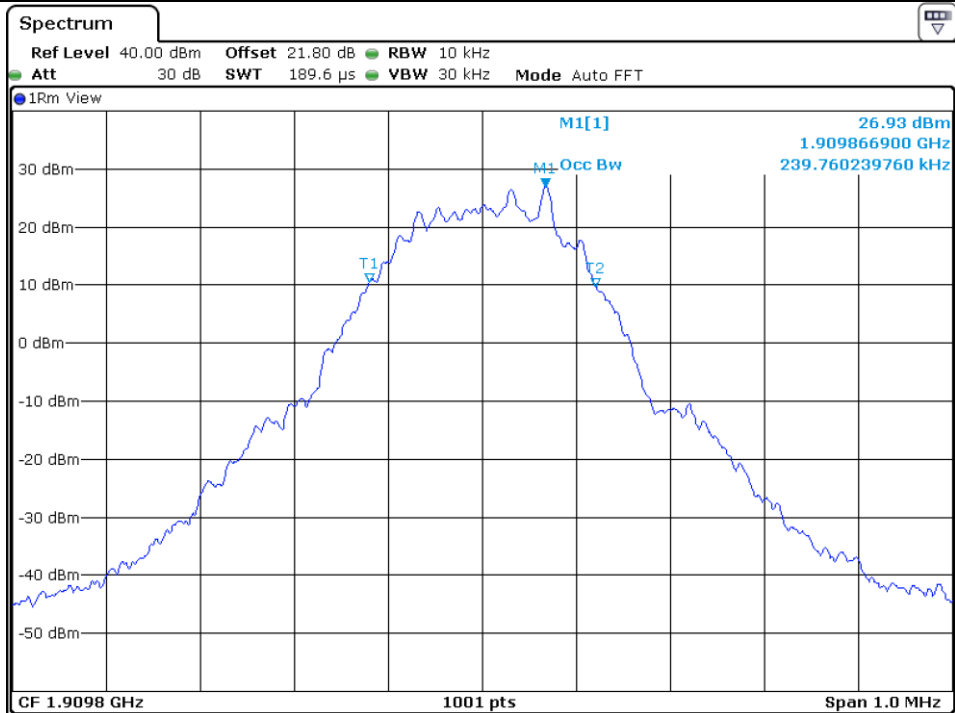
Middle Channel (26 dB Bandwidth)



Middle Channel (99 % Occupied Bandwidth)



High Channel (26 dB Bandwidth)



High Channel (99 % Occupied Bandwidth)

12.4.3 Test data for WCDMA Band 5

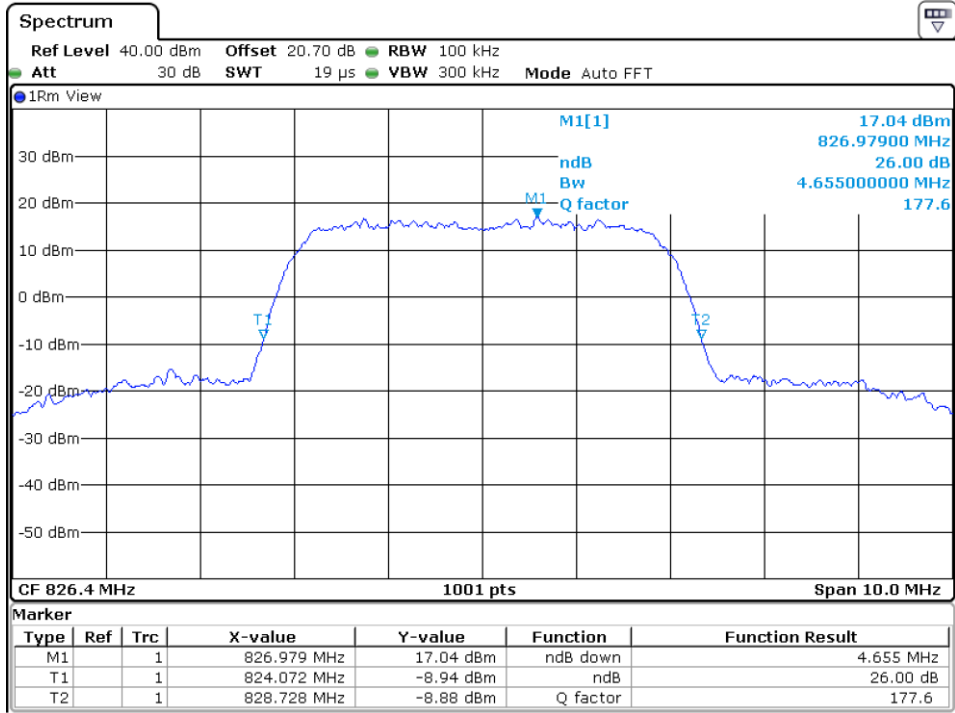
-. Test Date : July 16, 2018 ~ August 14, 2018

-. Test Result : Pass

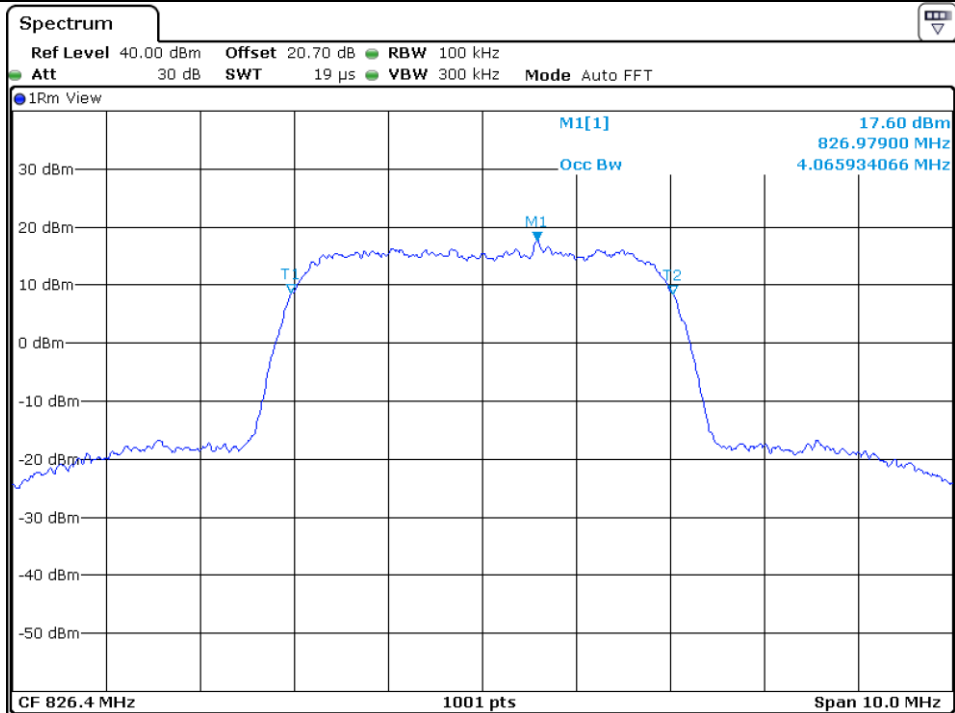
Band	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
WCDMA Band 5	Low	4.655	4.066	PASS
	Middle	4.675	4.076	PASS
	High	4.645	4.066	PASS



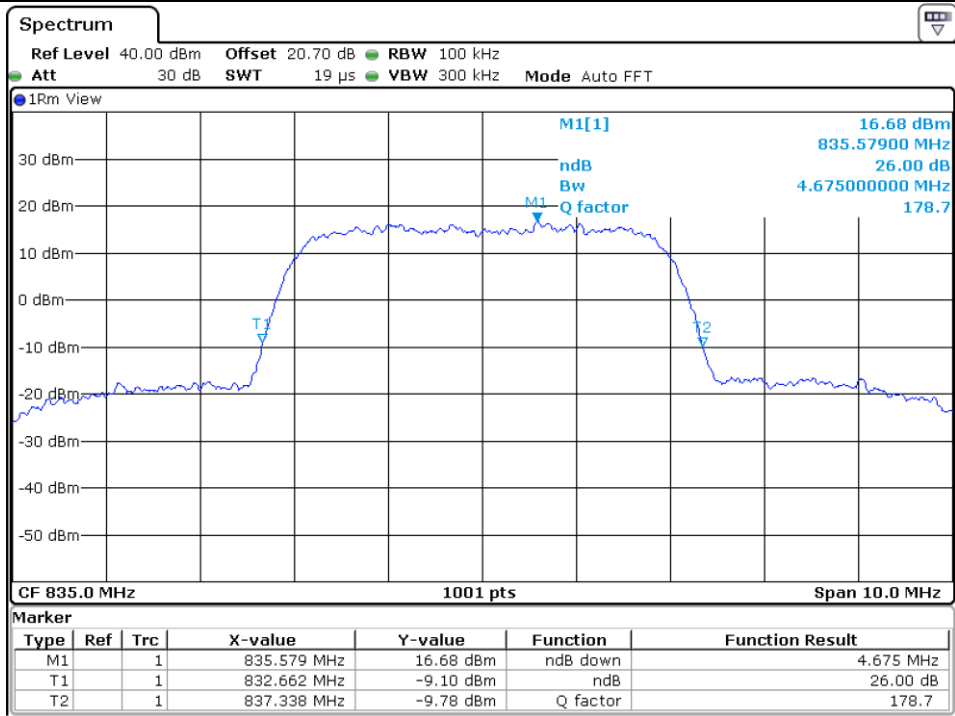
Tested by: Ha-Ram, Lee / Assistant Manager



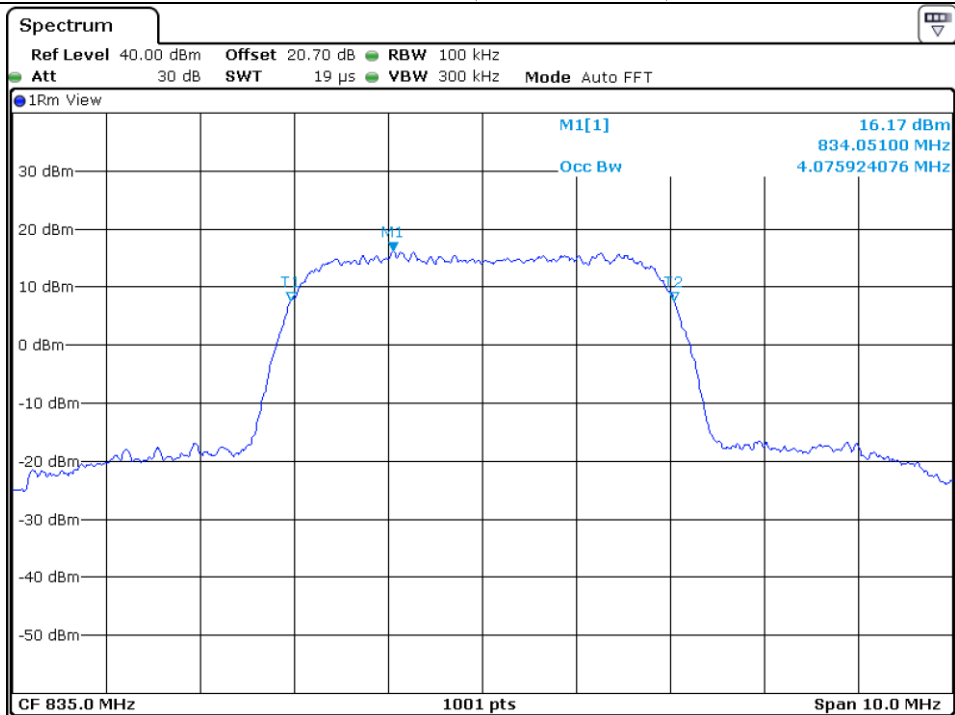
Low Channel (26 dB Bandwidth)



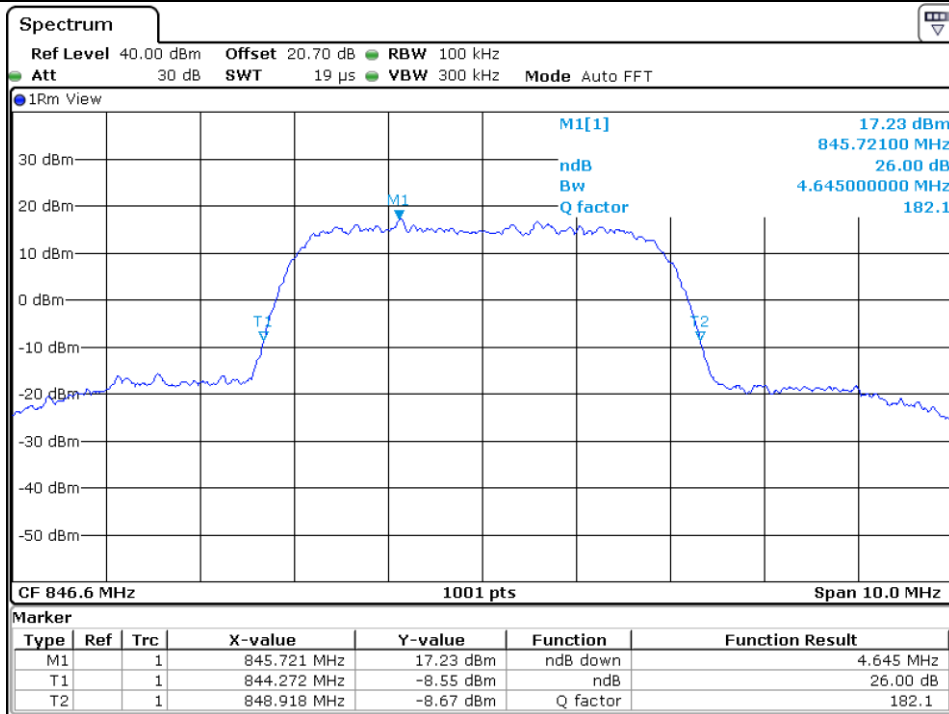
Low Channel (99 % Occupied Bandwidth)



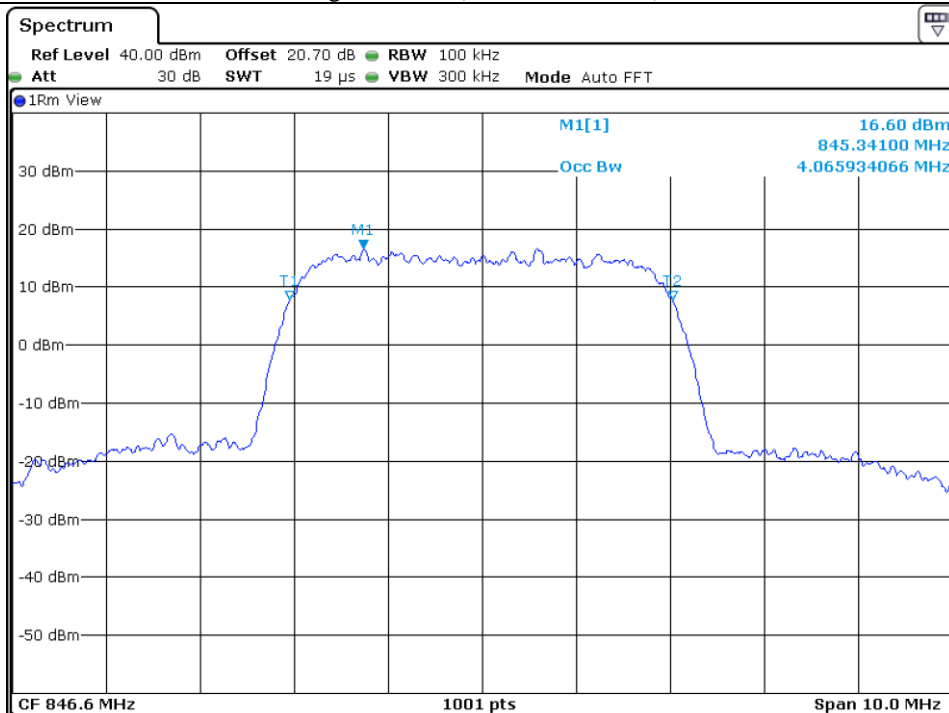
Middle Channel (26 dB Bandwidth)



Middle Channel (99 % Occupied Bandwidth)



High Channel (26 dB Bandwidth)



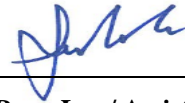
High Channel (99 % Occupied Bandwidth)

12.4.4 Test data for WCDMA Band 2

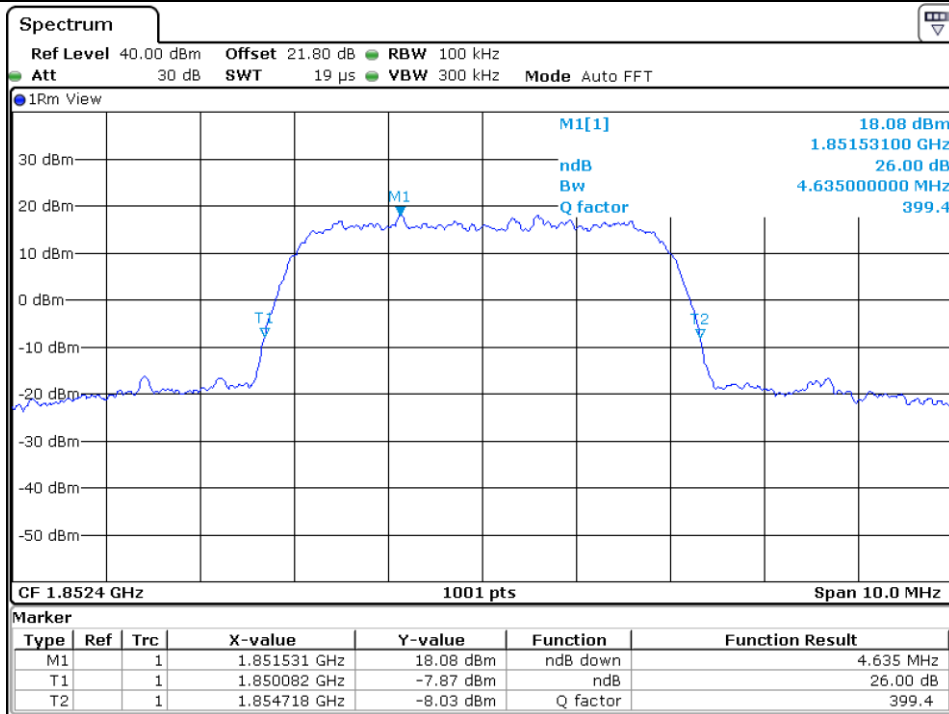
-. Test Date : July 16, 2018 ~ August 14, 2018

-. Test Result : Pass

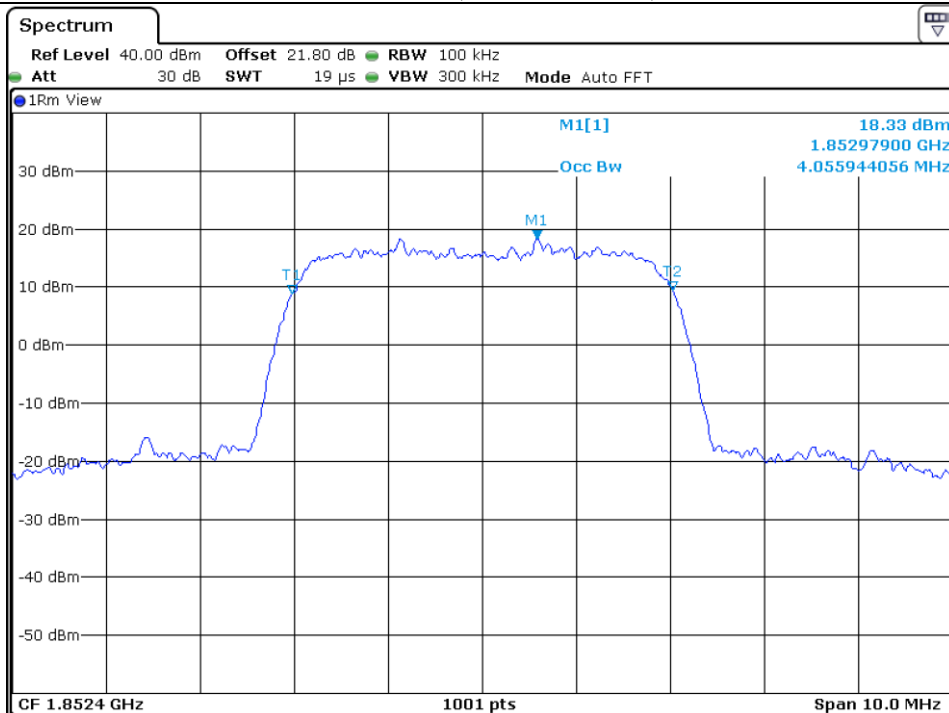
Band	Channel	26 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Result
WCDMA Band 2	Low	4.635	4.056	PASS
	Middle	4.635	4.056	PASS
	High	4.625	4.056	PASS



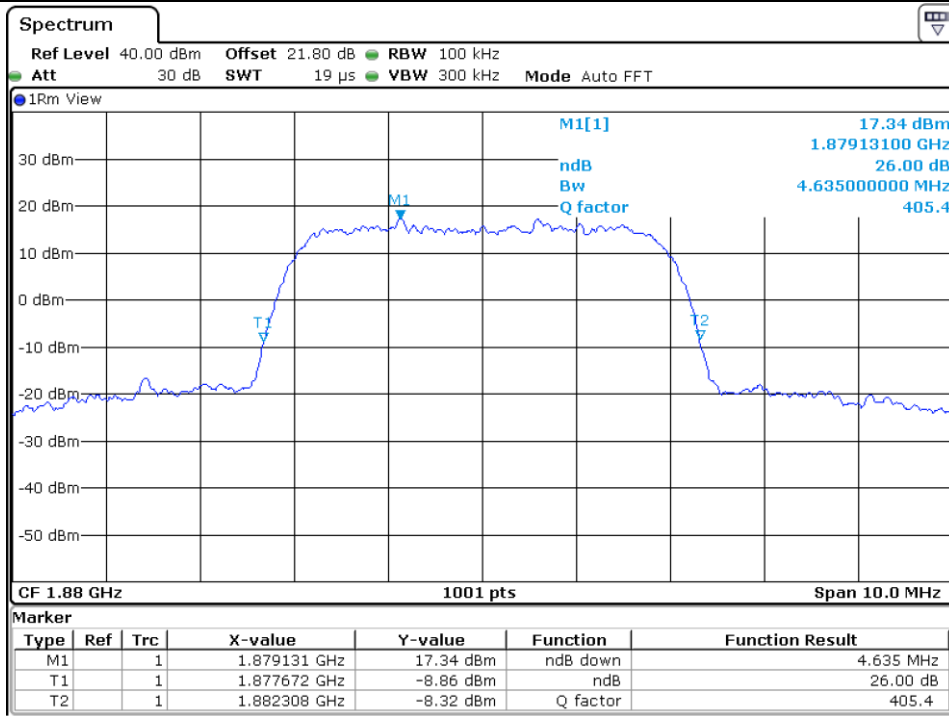
Tested by: Ha-Ram, Lee / Assistant Manager



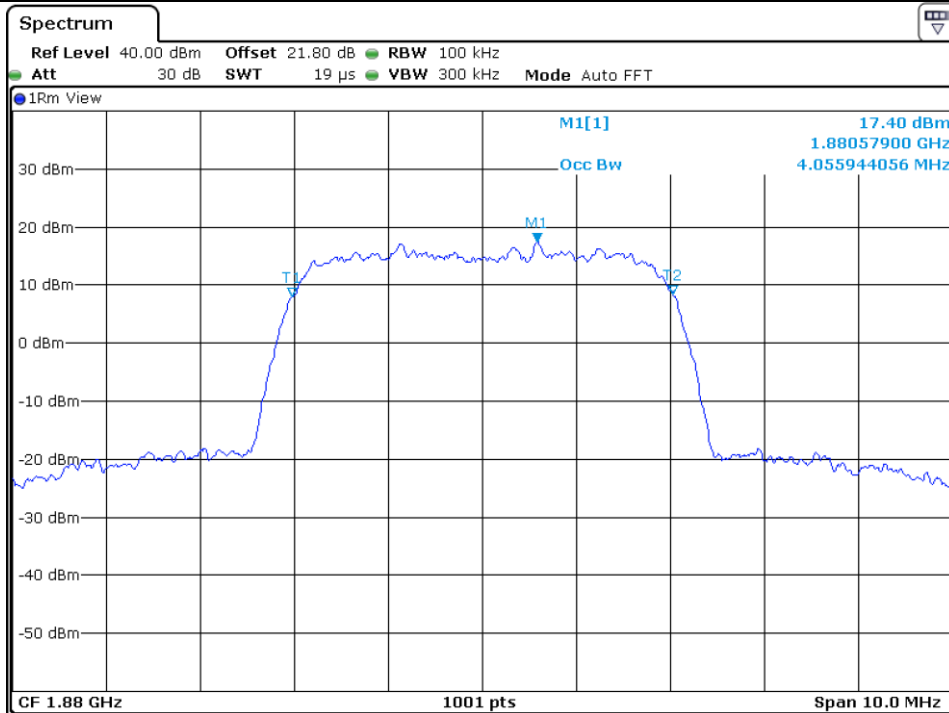
Low Channel (26 dB Bandwidth)



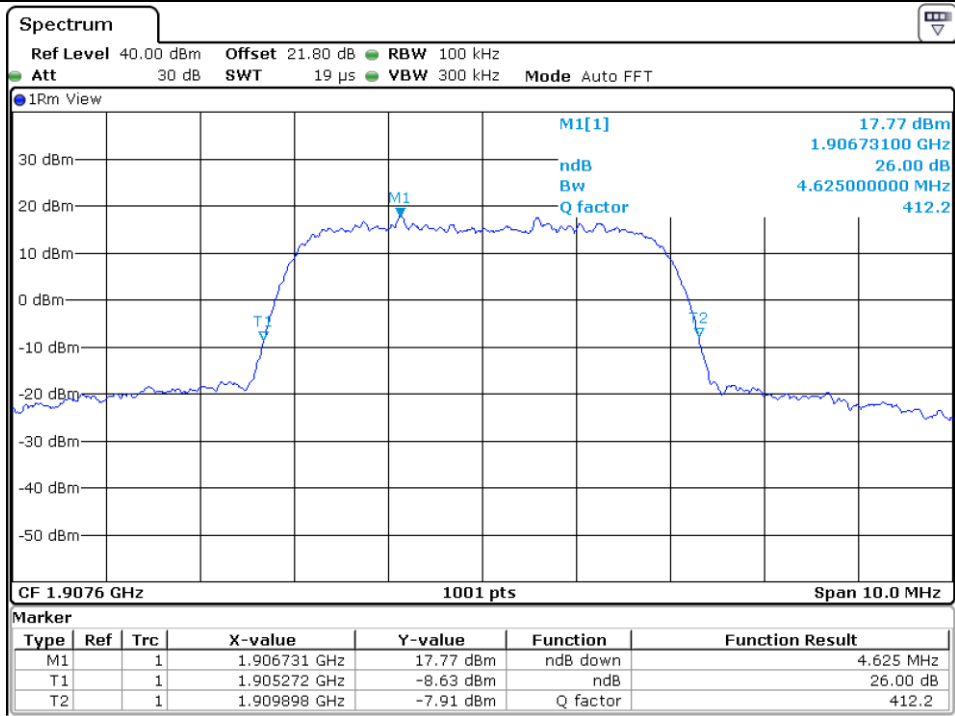
Low Channel (99 % Occupied Bandwidth)



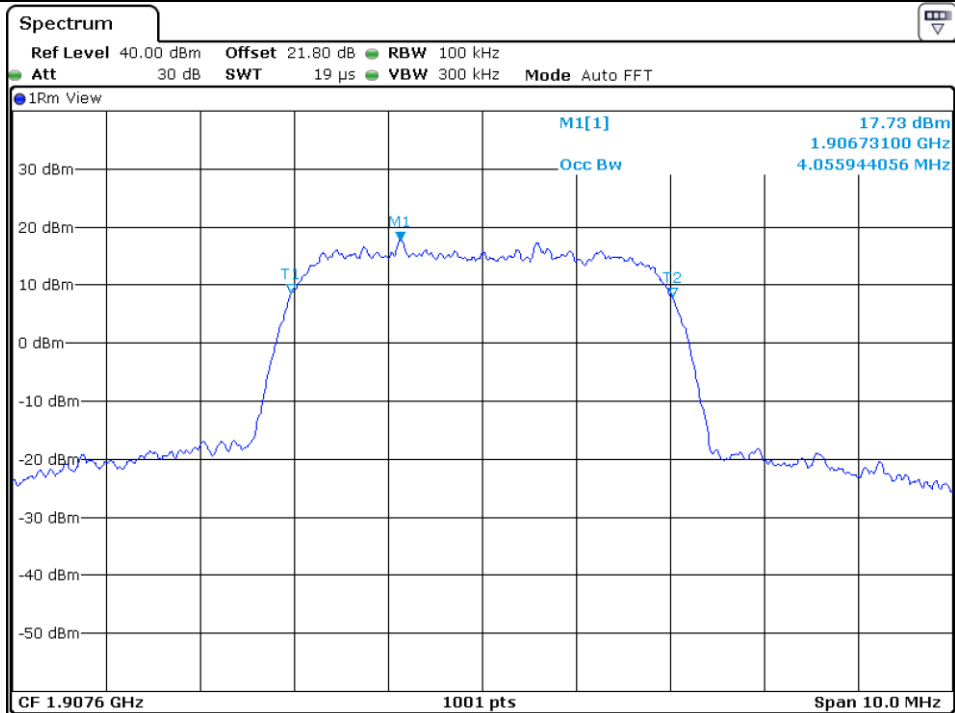
Middle Channel (26 dB Bandwidth)



Middle Channel (99 % Occupied Bandwidth)



High Channel (26 dB Bandwidth)



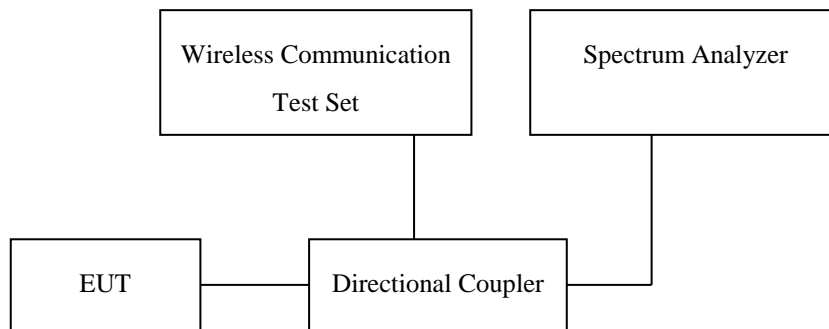
High Channel (99 % Occupied Bandwidth)

13. CONDUCTED SPURIOUS EMISSIONS

13.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

13.2 Test set-up



(Configuration of conducted Emission measurement)

Conducted Spurious Emissions is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v0 4, April 9, 2018, Section 6 and RSS-Gen, November 2014, Issue4, Section 6.6

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels(low, middle and high operational range.)

The Conducted Spurious Emissions used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

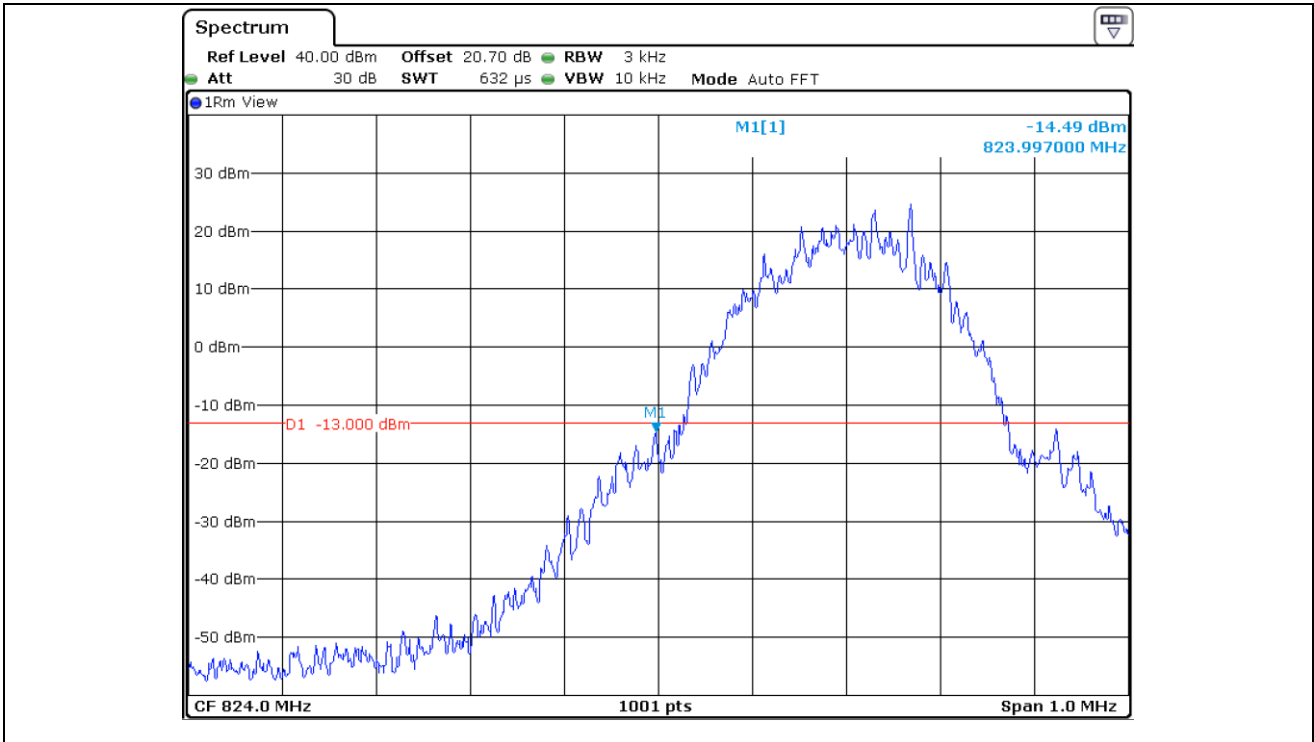
13.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)
■ - CMW500	Rohde & Schwarz	WIDEBAND RADIO COMMUNICATION TESTER	127298	Mar. 15, 2018 (1Y)
■ - Directional Coupler	AA-MCS	AAMCS-UDC	400	Aug. 23, 2018 (1Y)

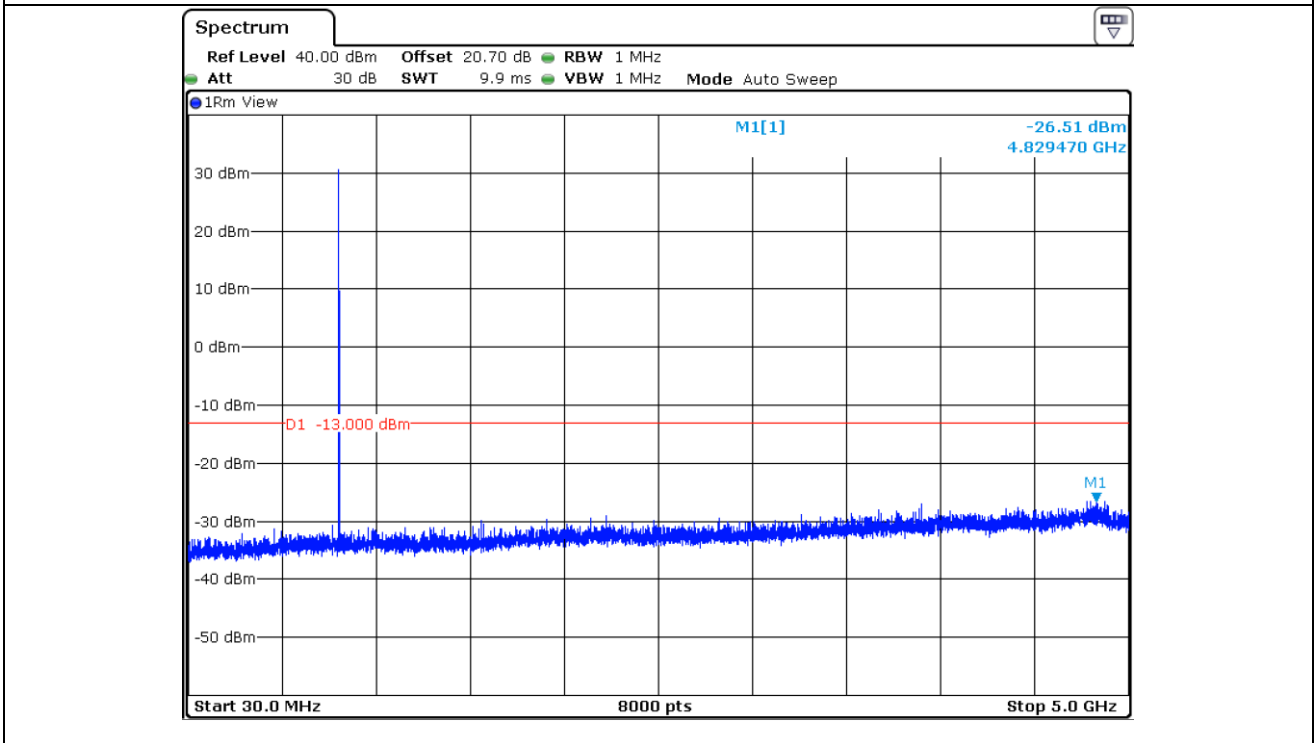
All test equipment used is calibrated on a regular basis.

13.4 Test data

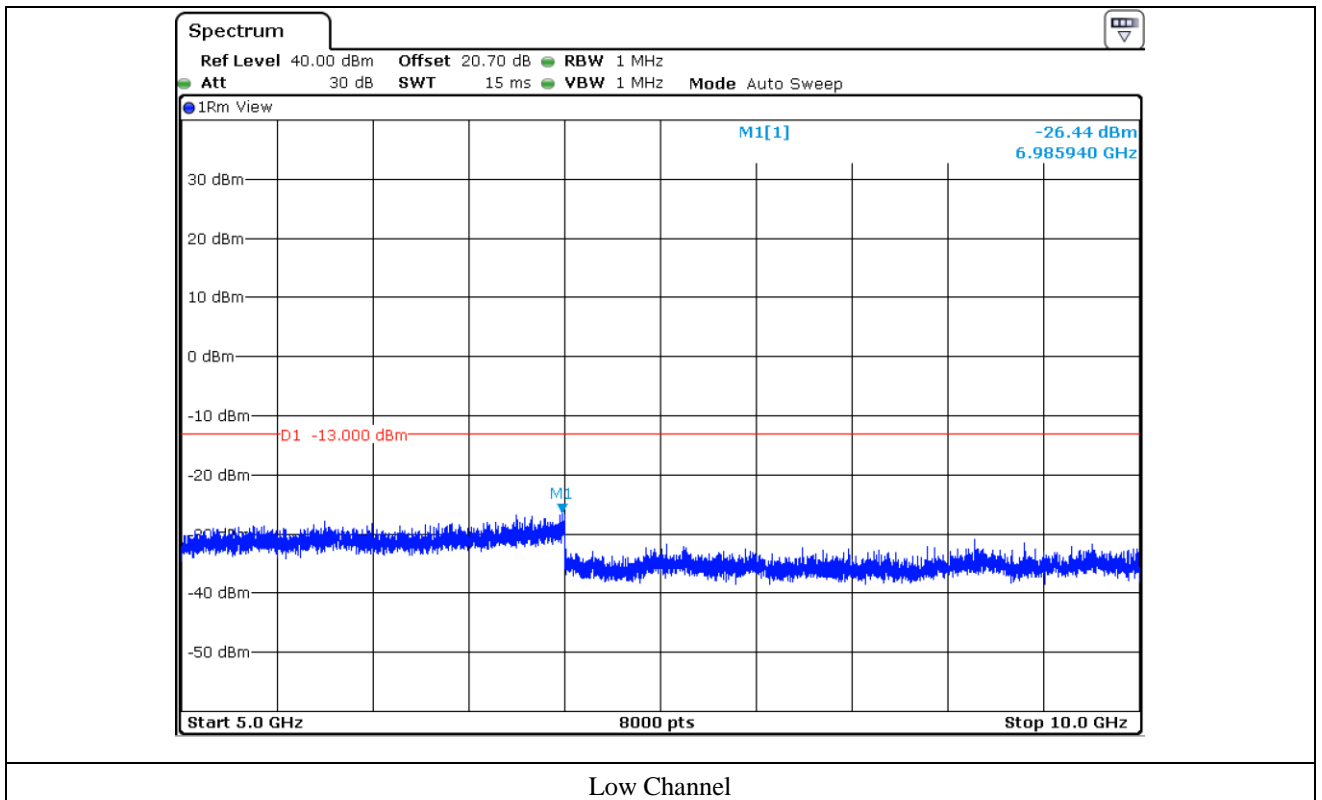
13.4.1 Test data for GSM850

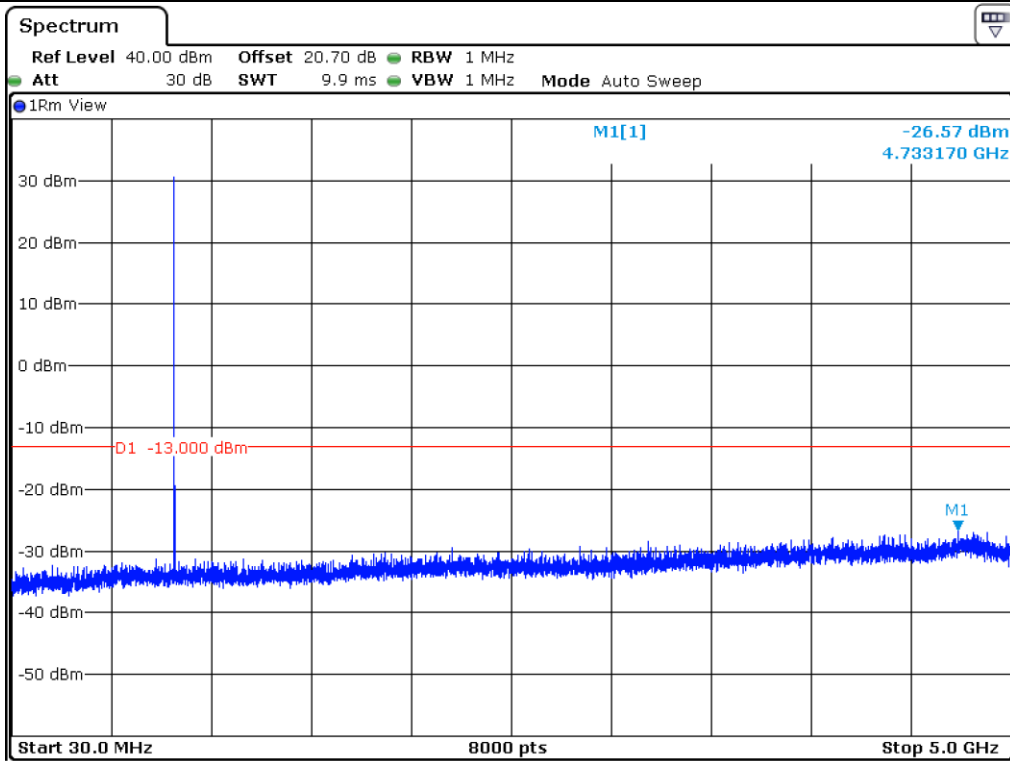


Low Channel

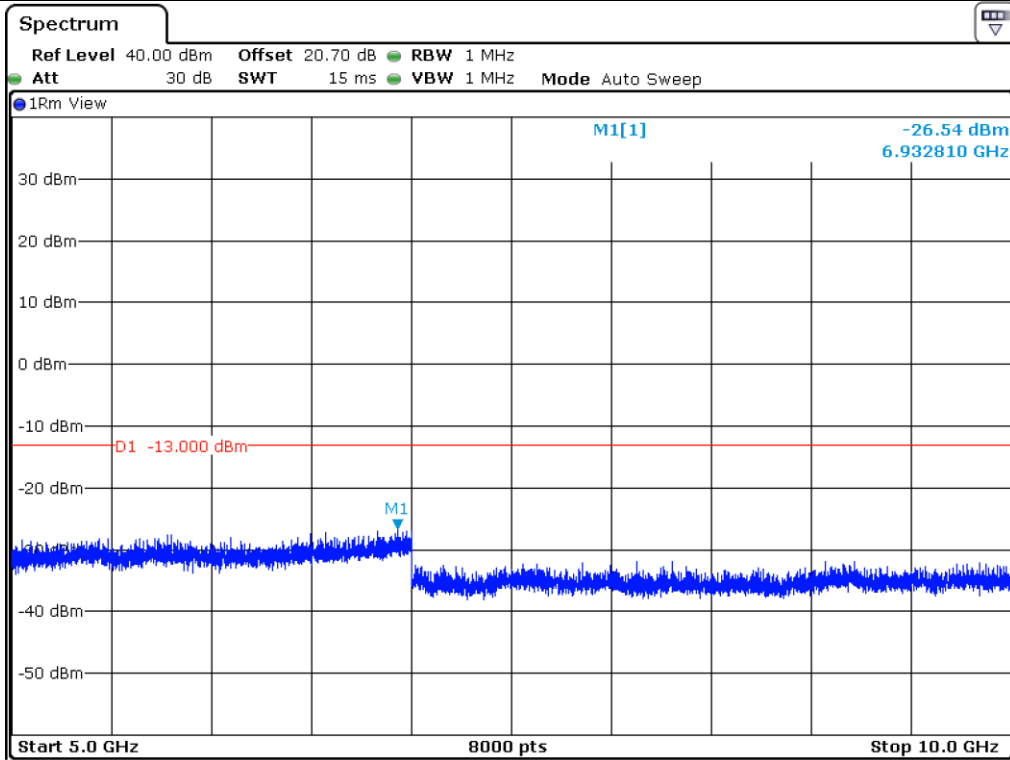


Low Channel





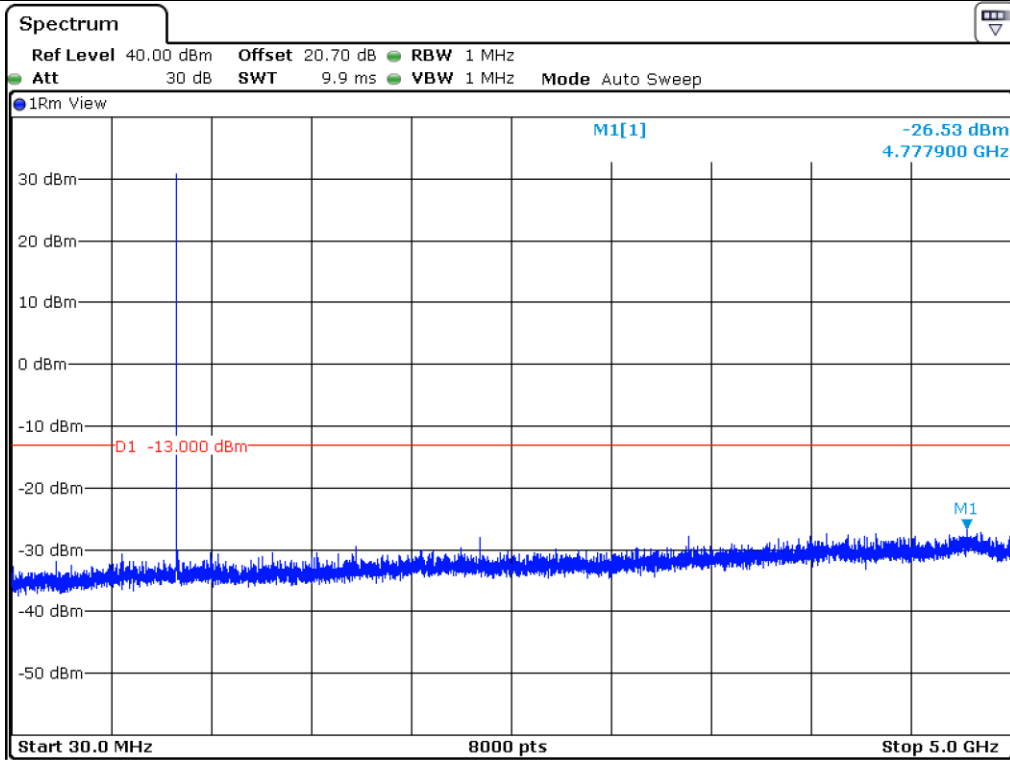
Middle Channel



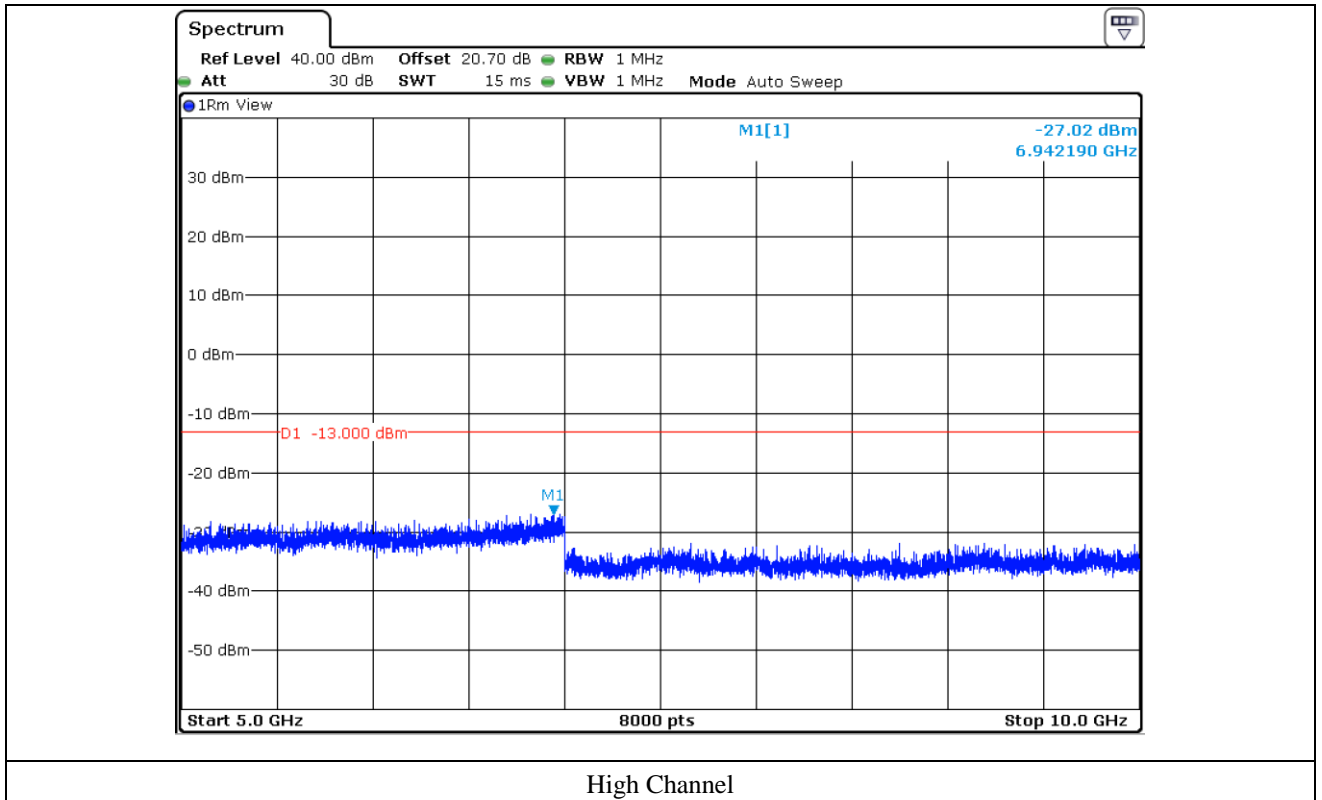
Middle Channel



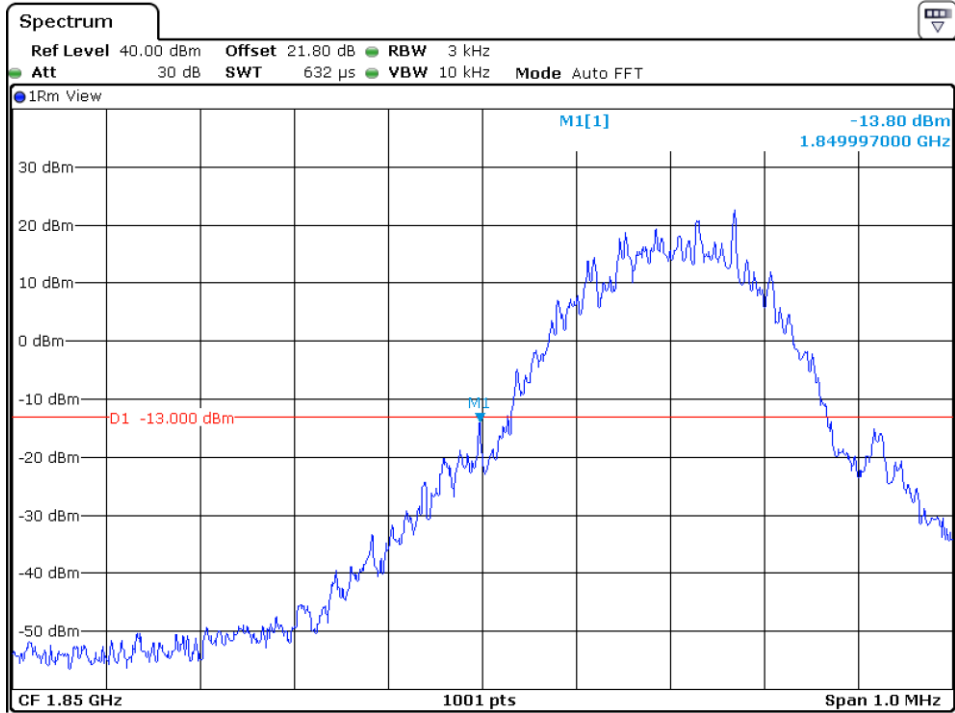
High Channel



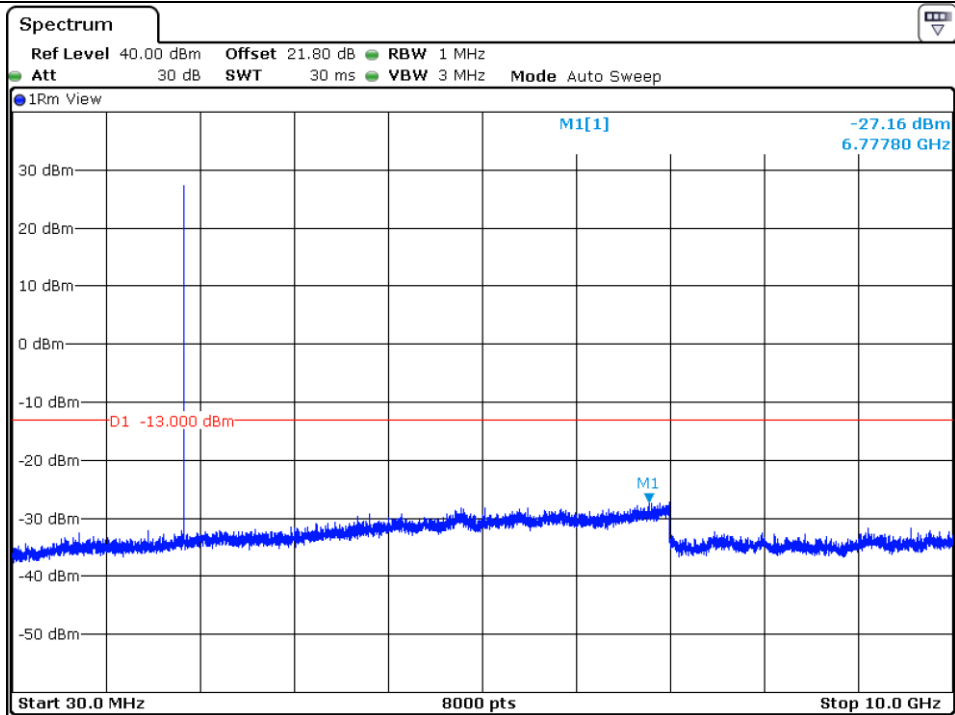
High Channel



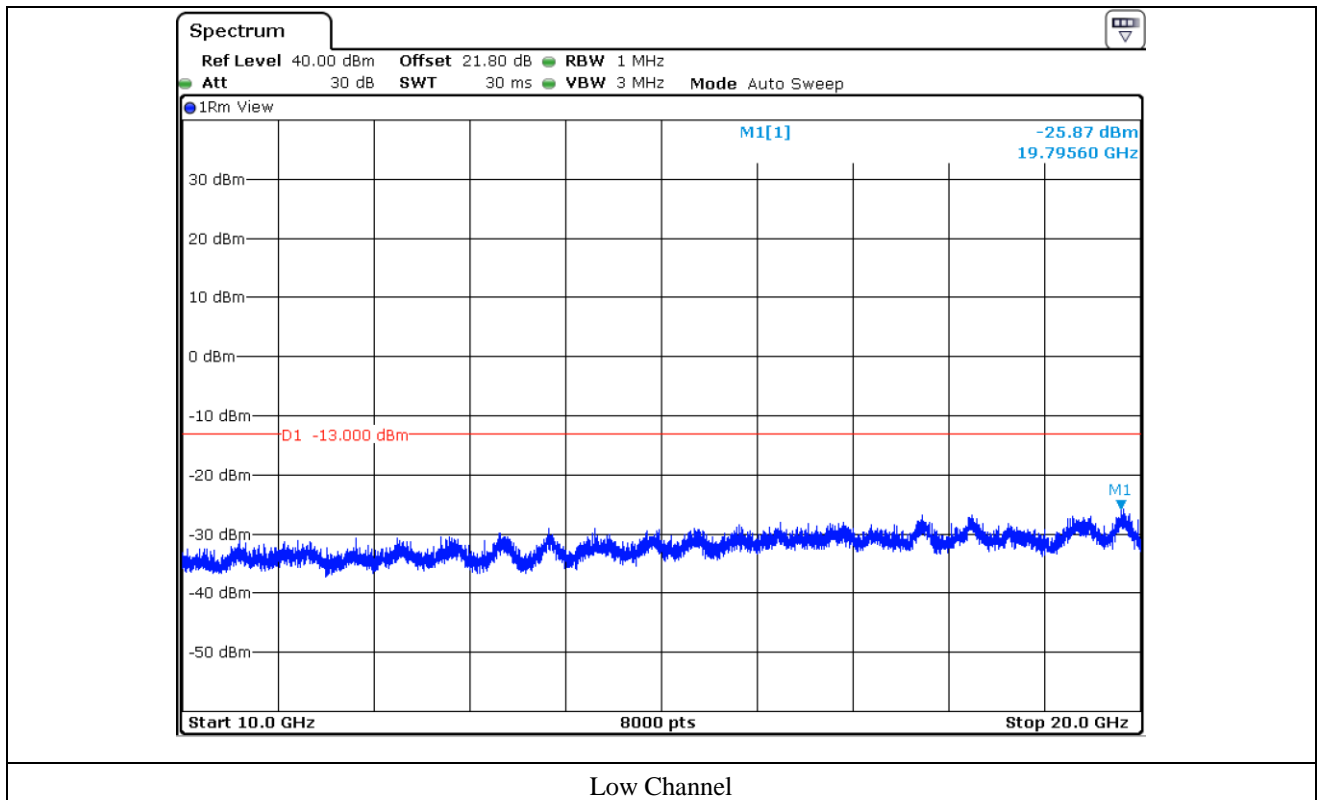
13.4.2 Test data for GSM1900

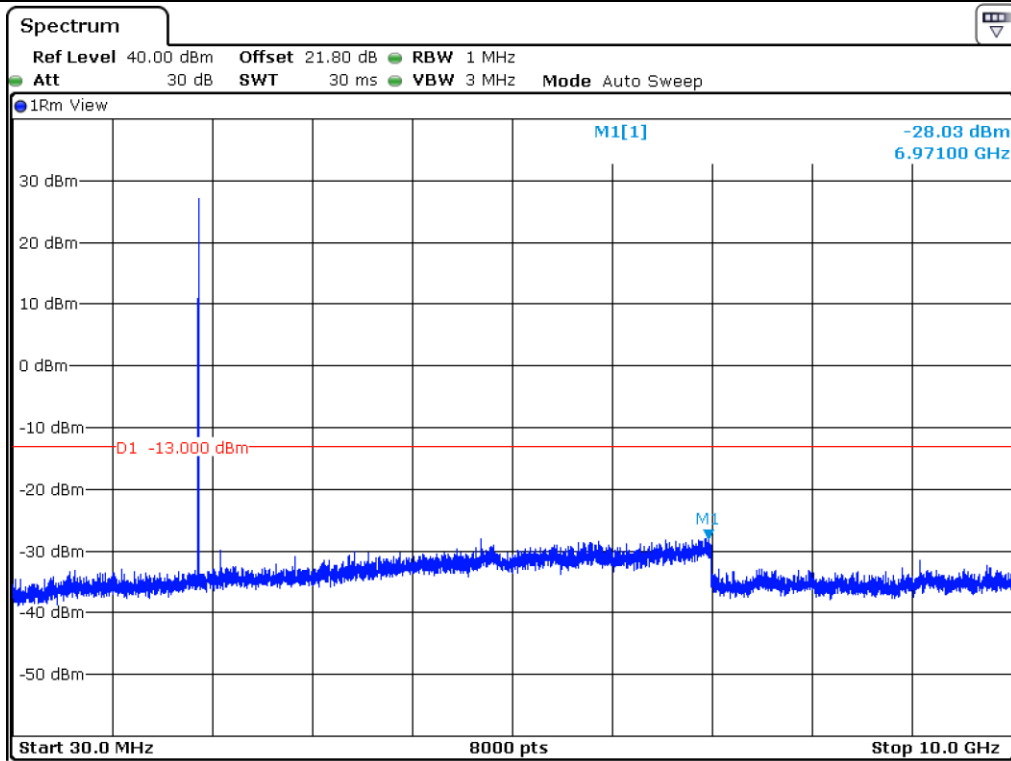


Low Channel

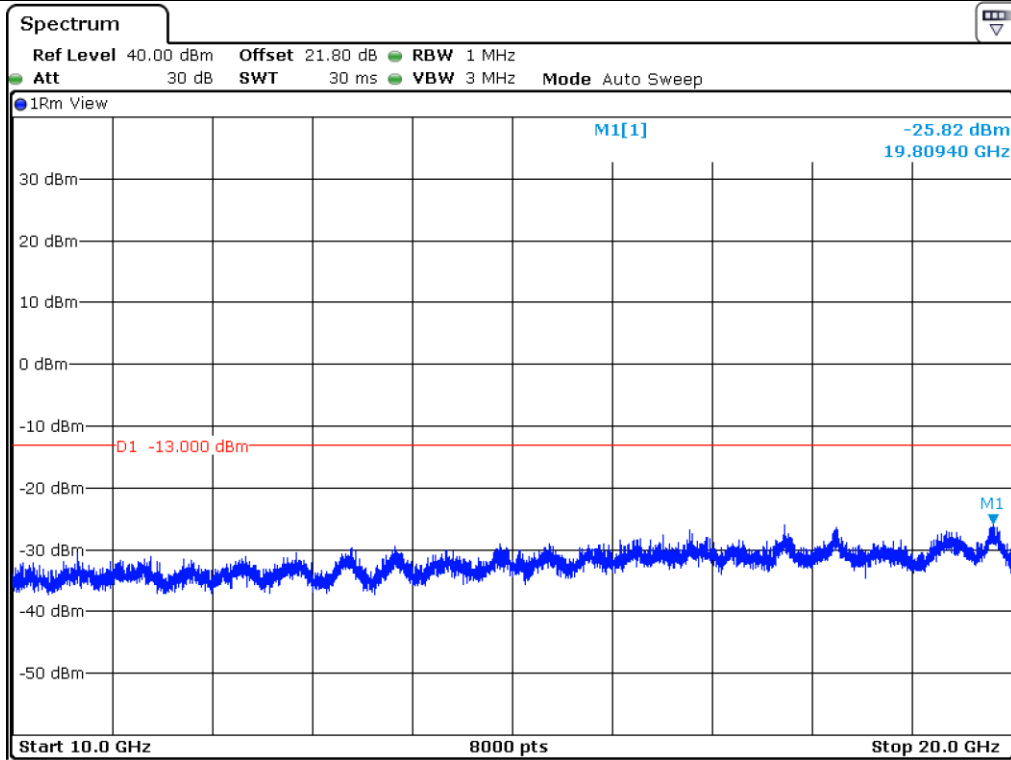


Low Channel

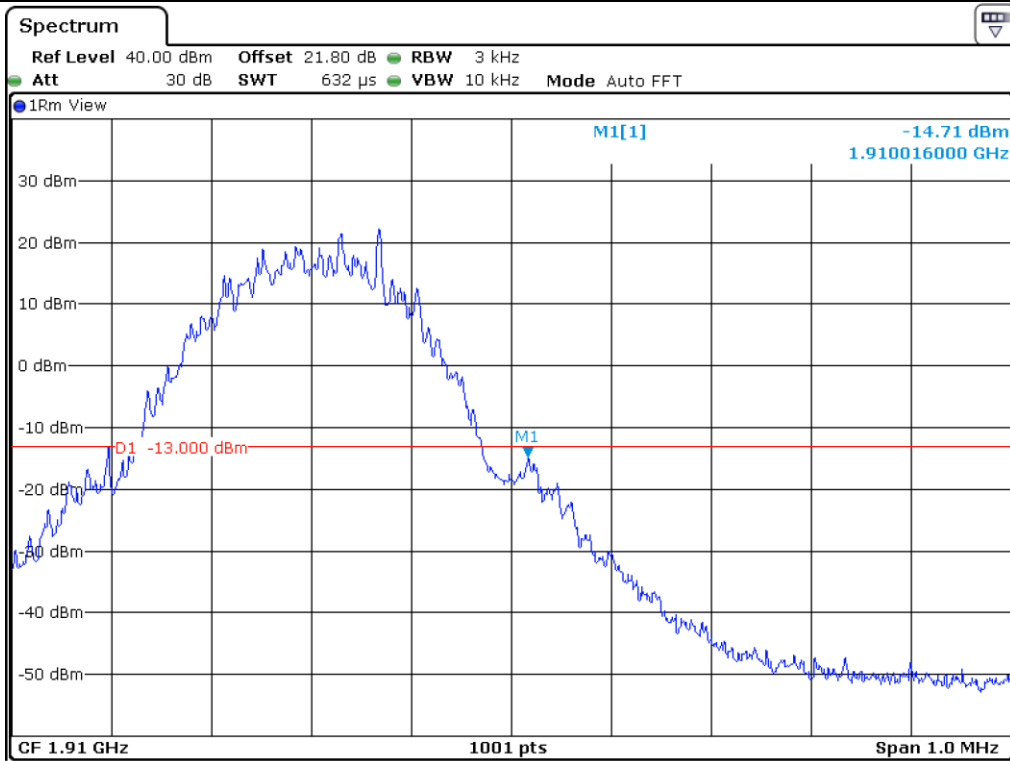




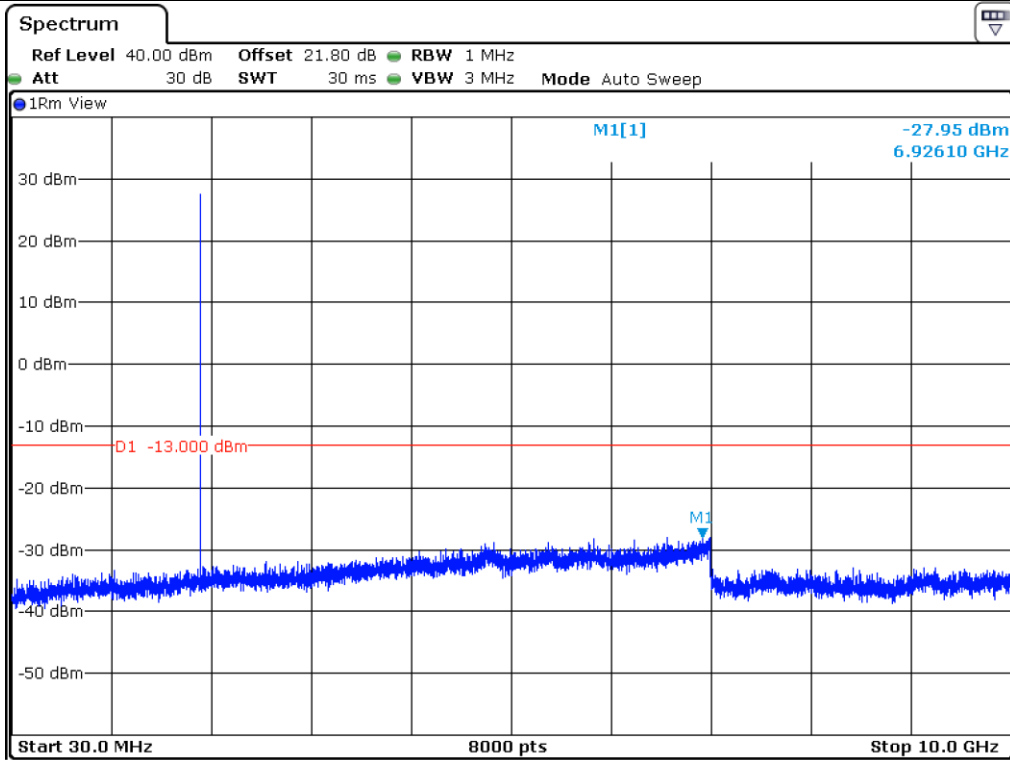
Midle Channel



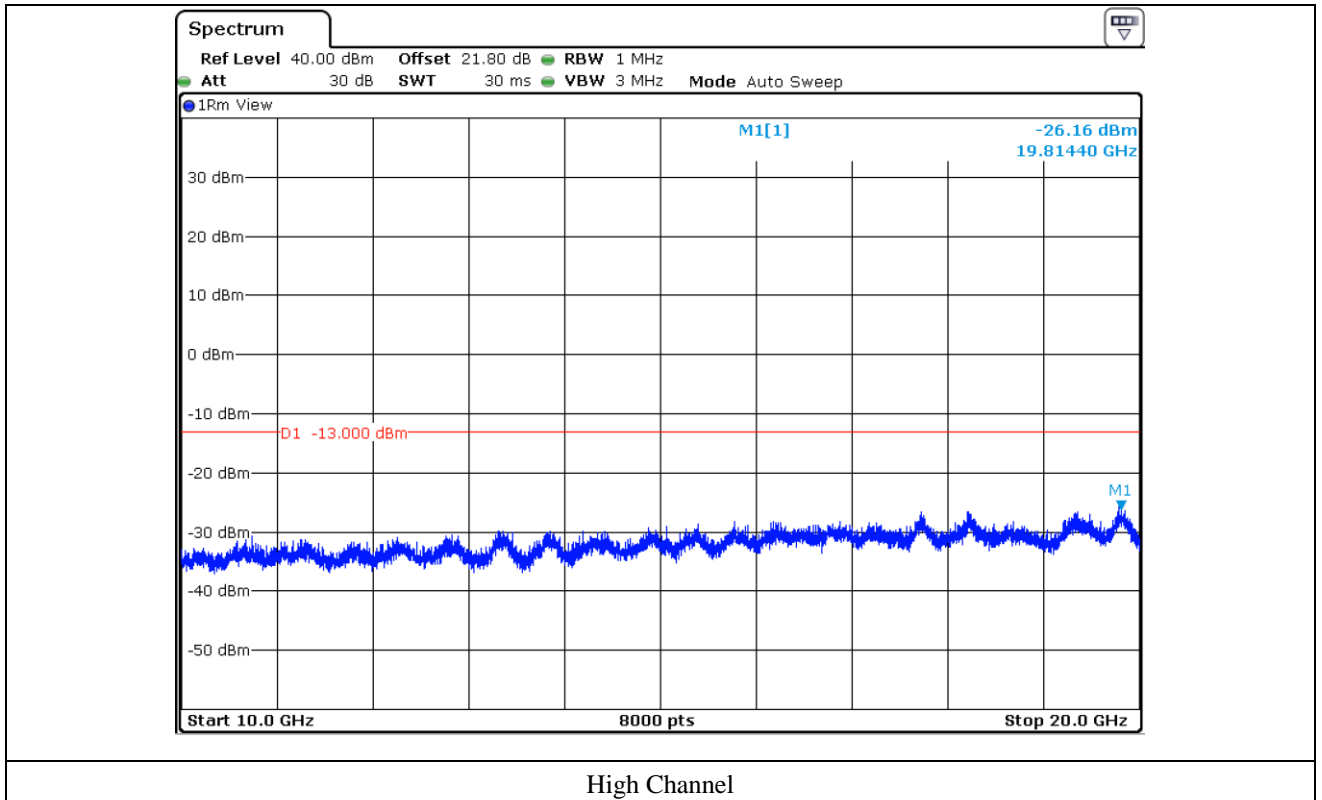
Midle Channel



High Channel

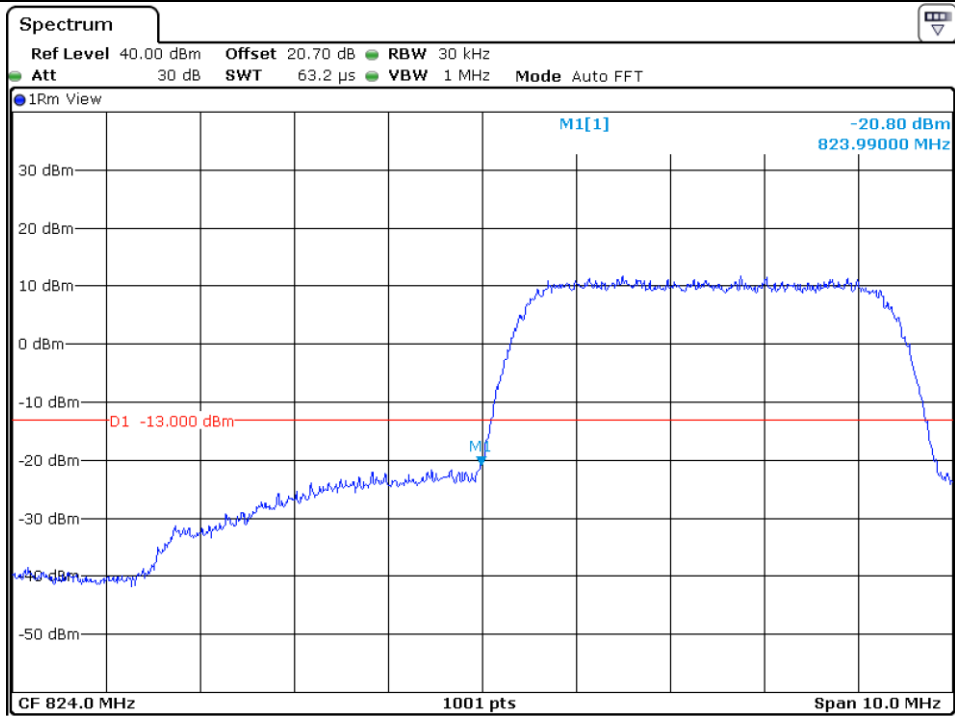


High Channel

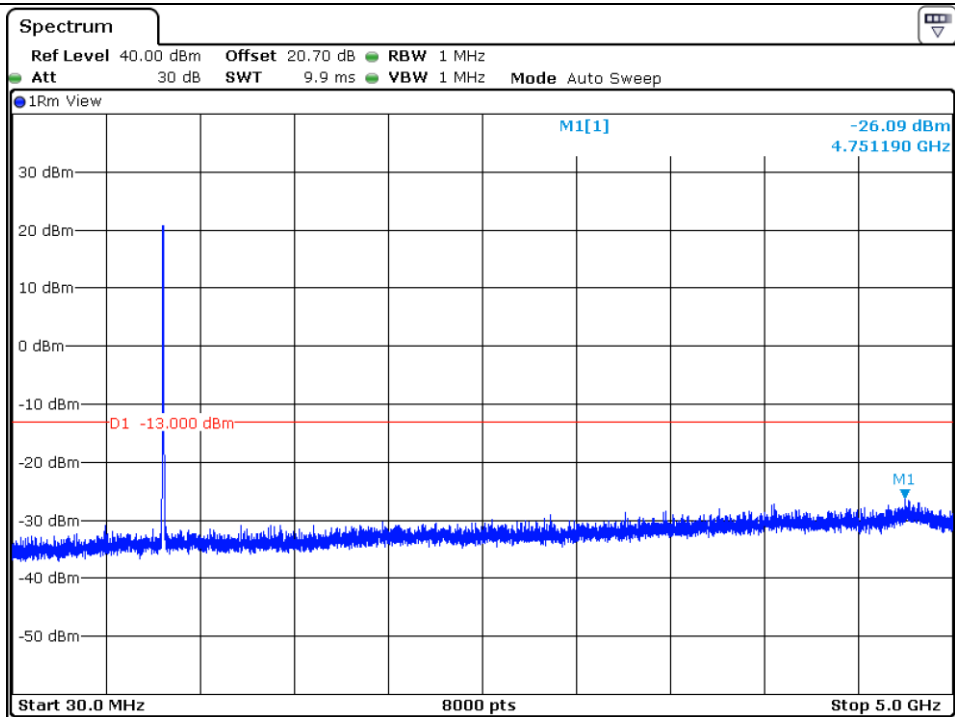


High Channel

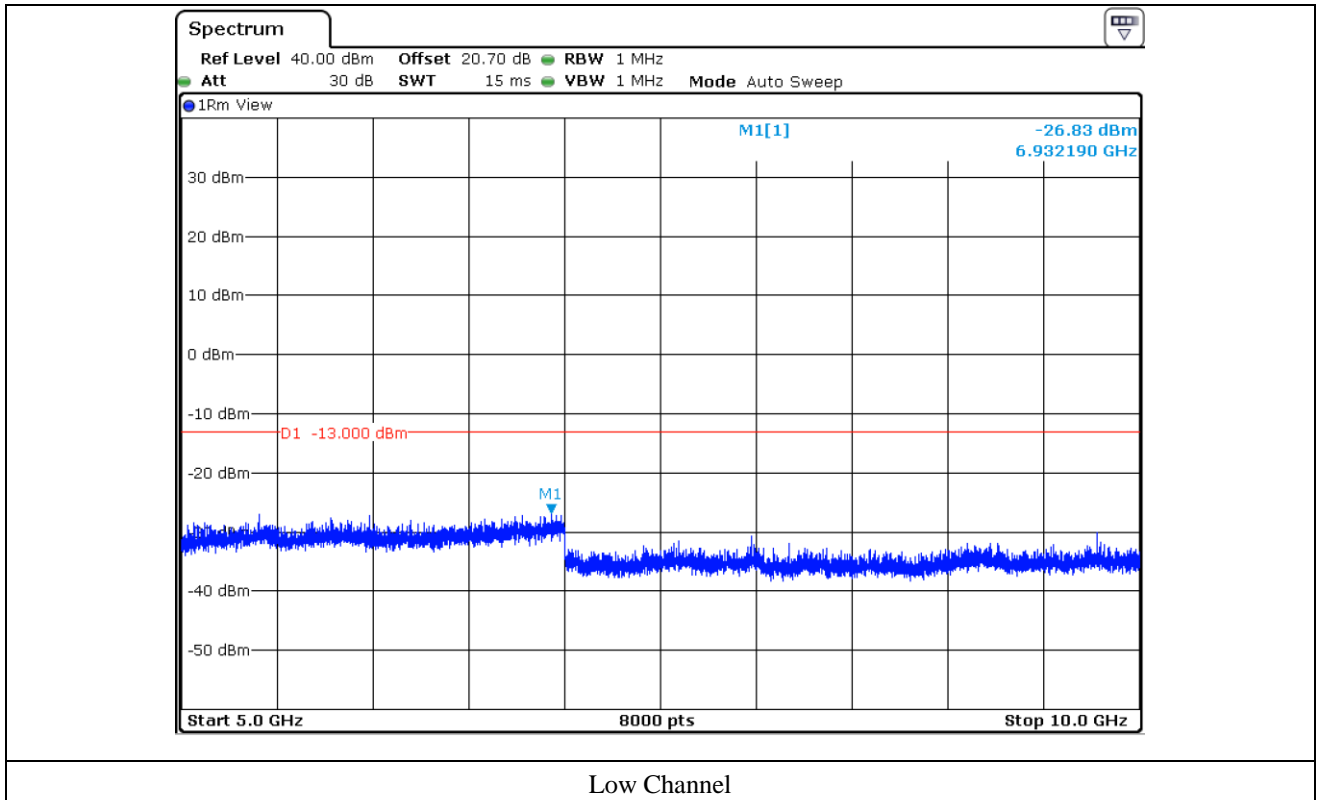
13.4.3 Test data for WCDMA Band 5

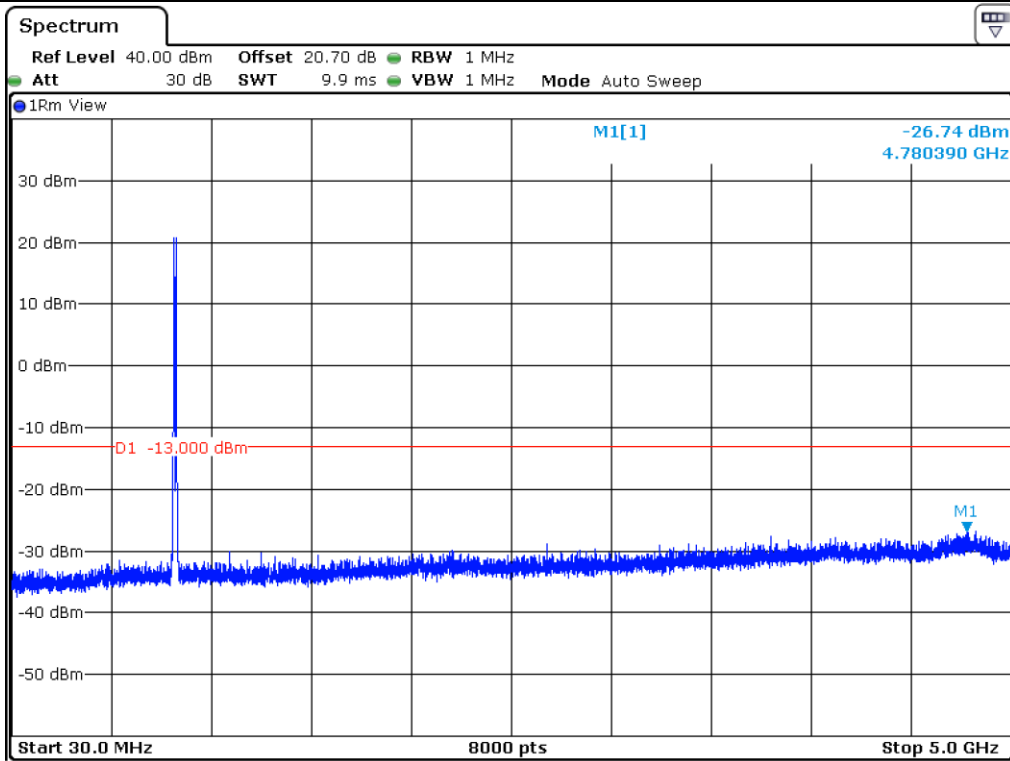


Low Channel

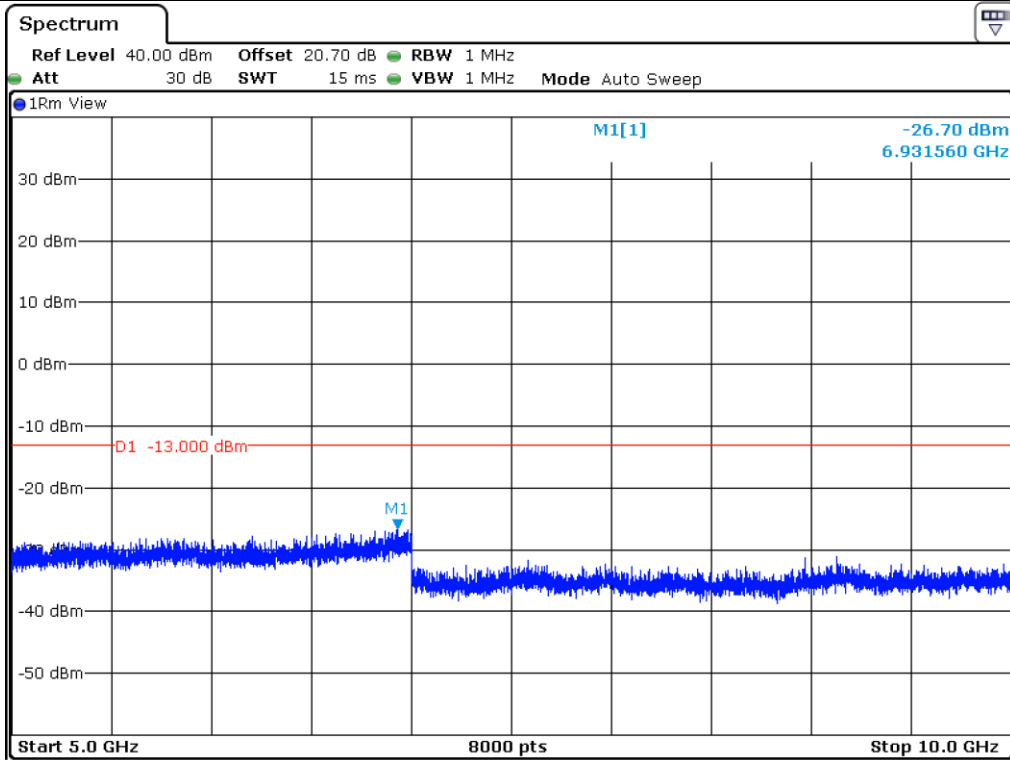


Low Channel

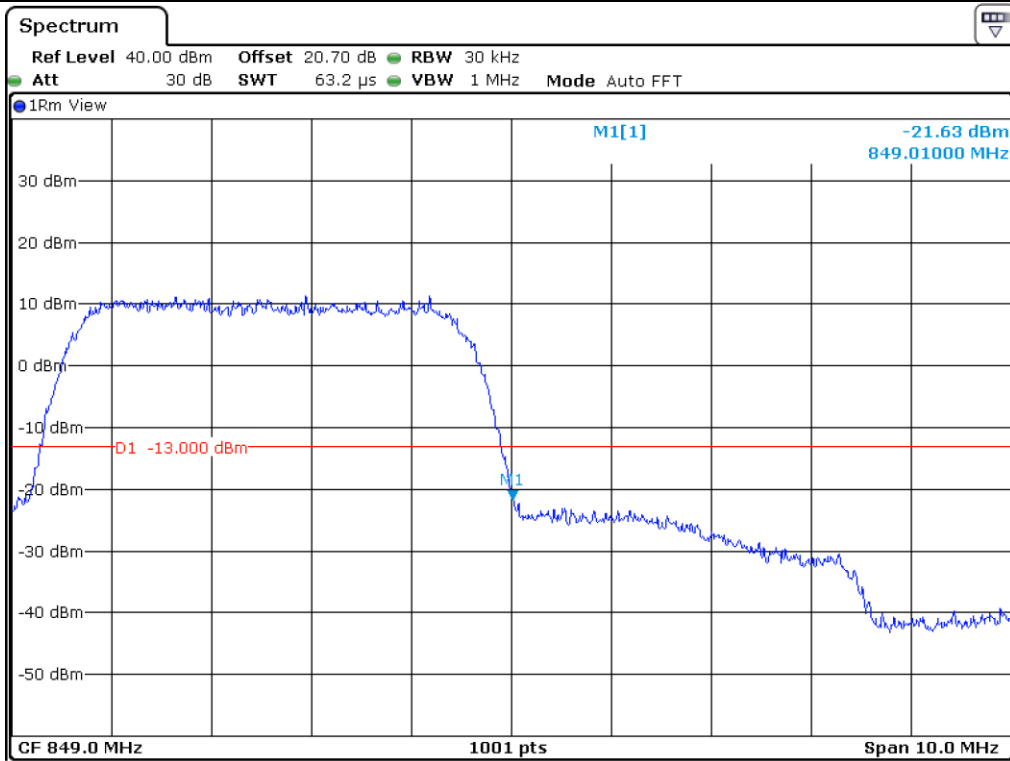




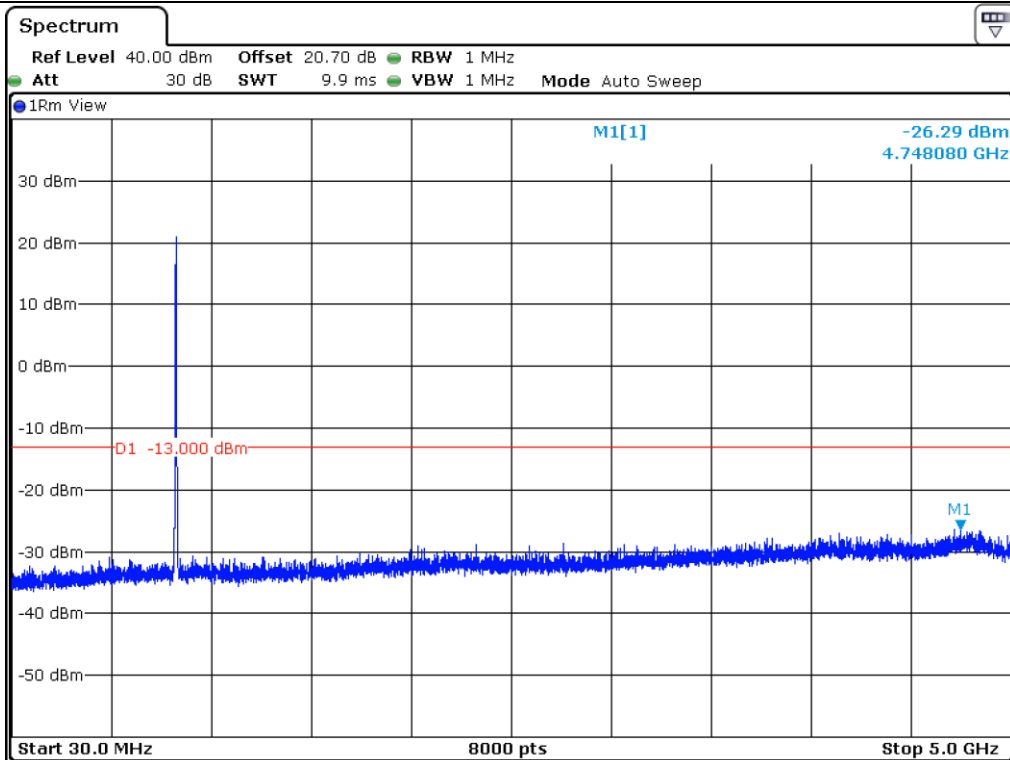
Midle Channel



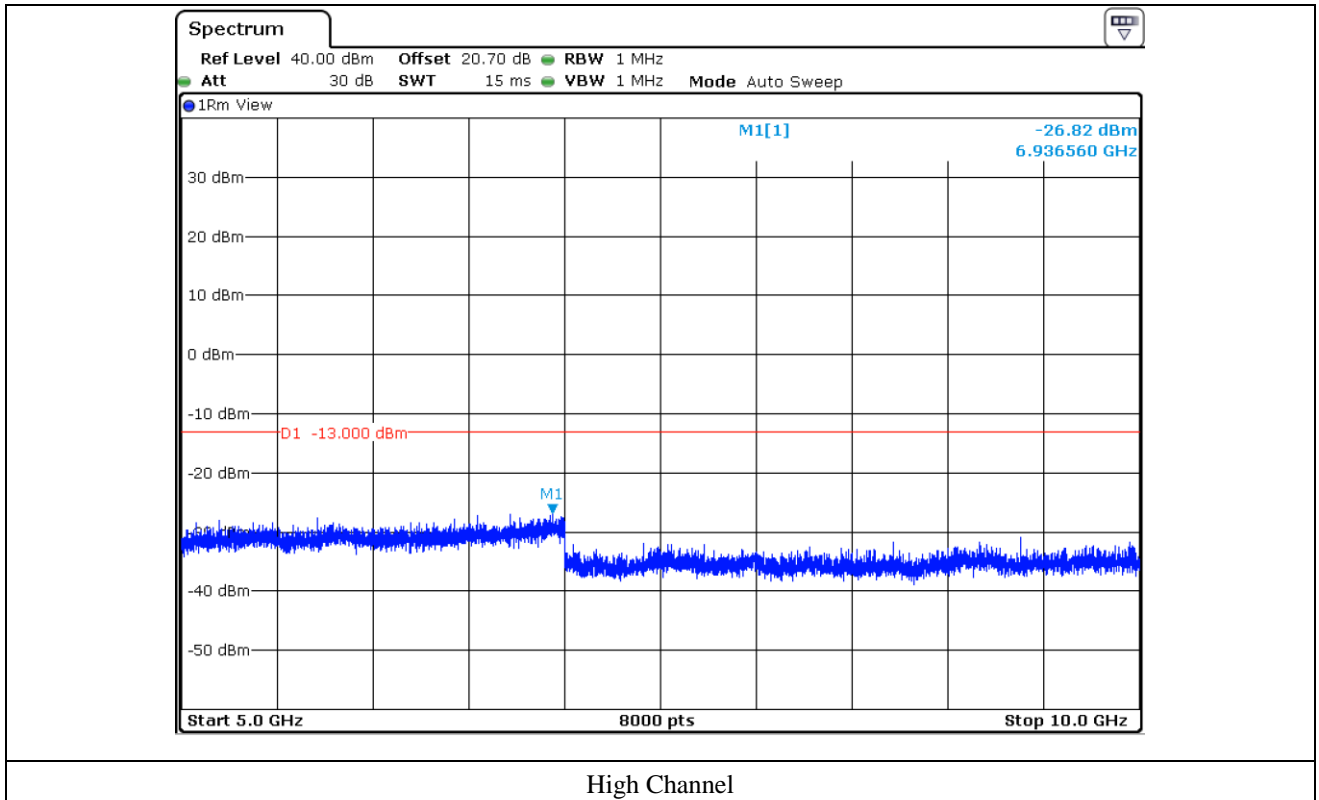
Midle Channel



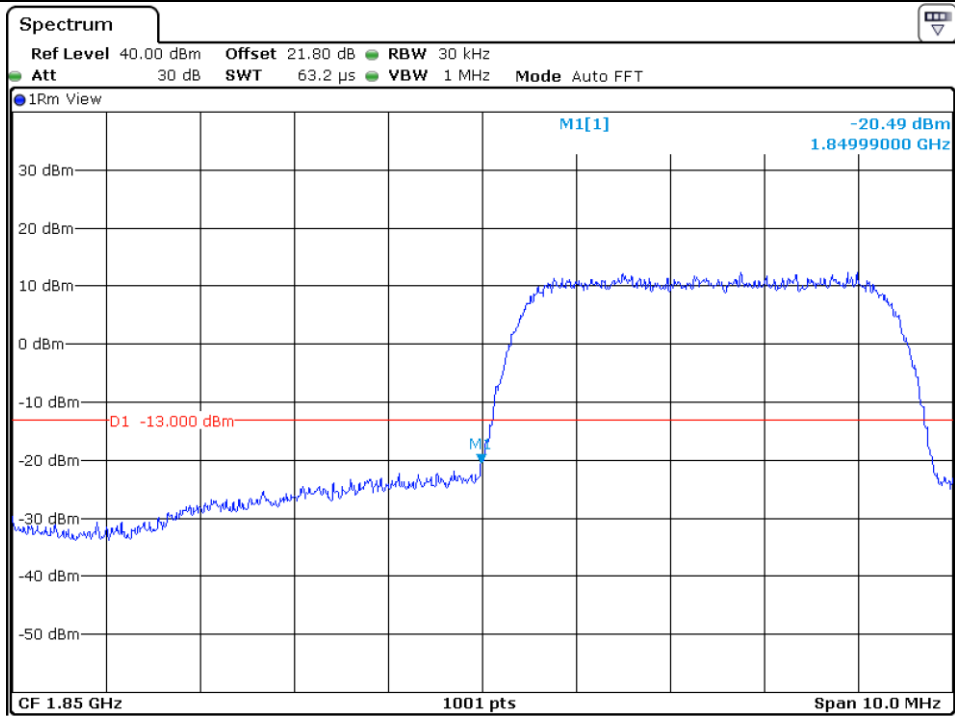
High Channel



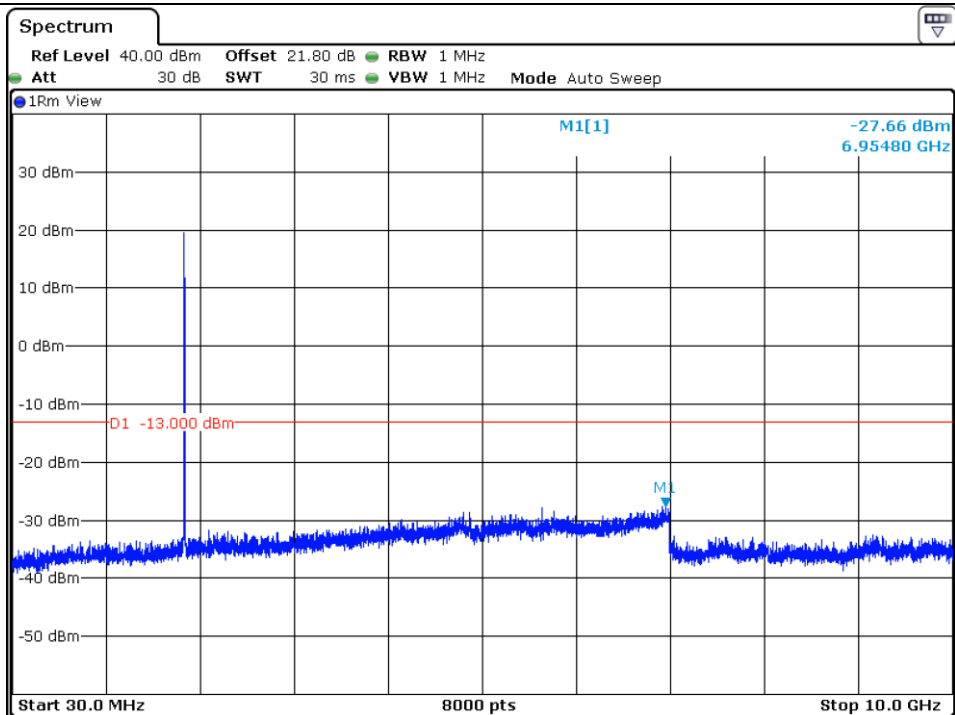
High Channel



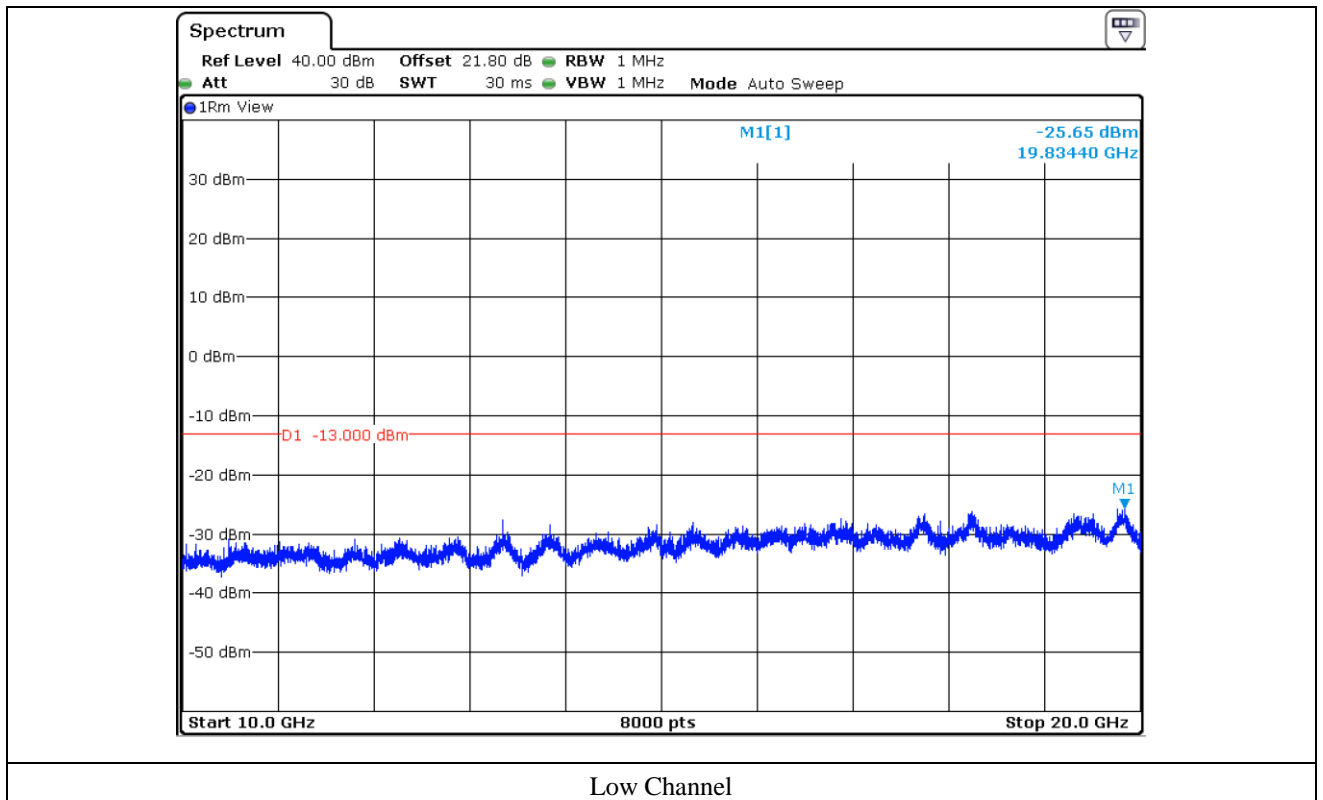
13.4.4 Test data for WCDMA Band 2

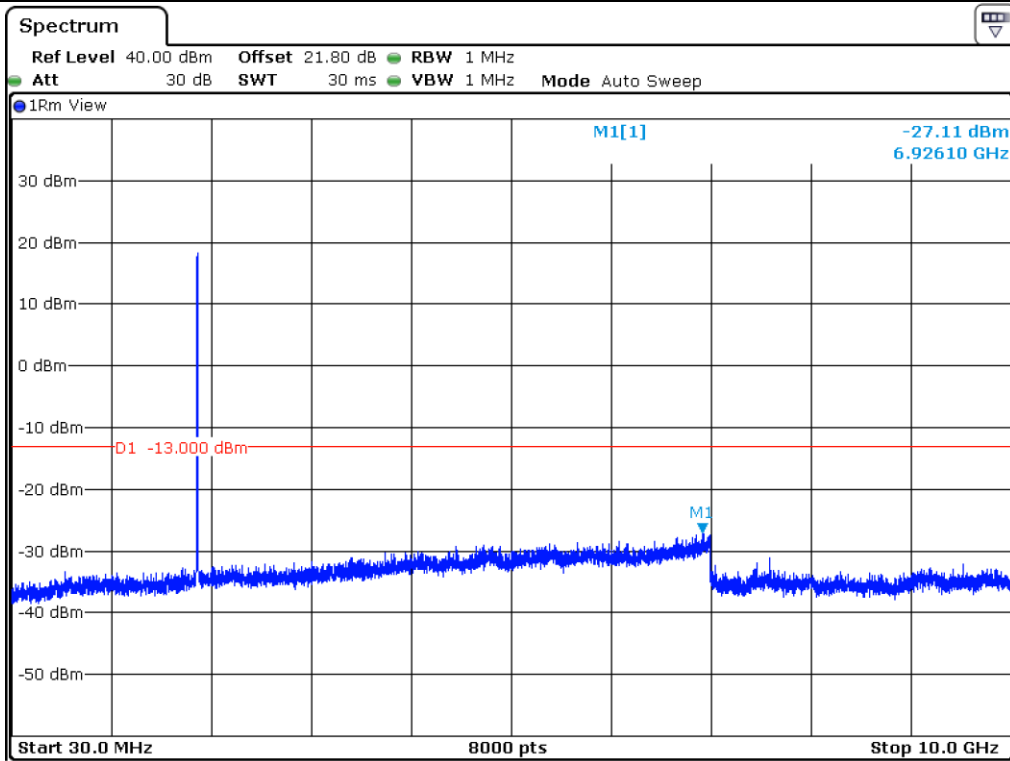


Low Channel

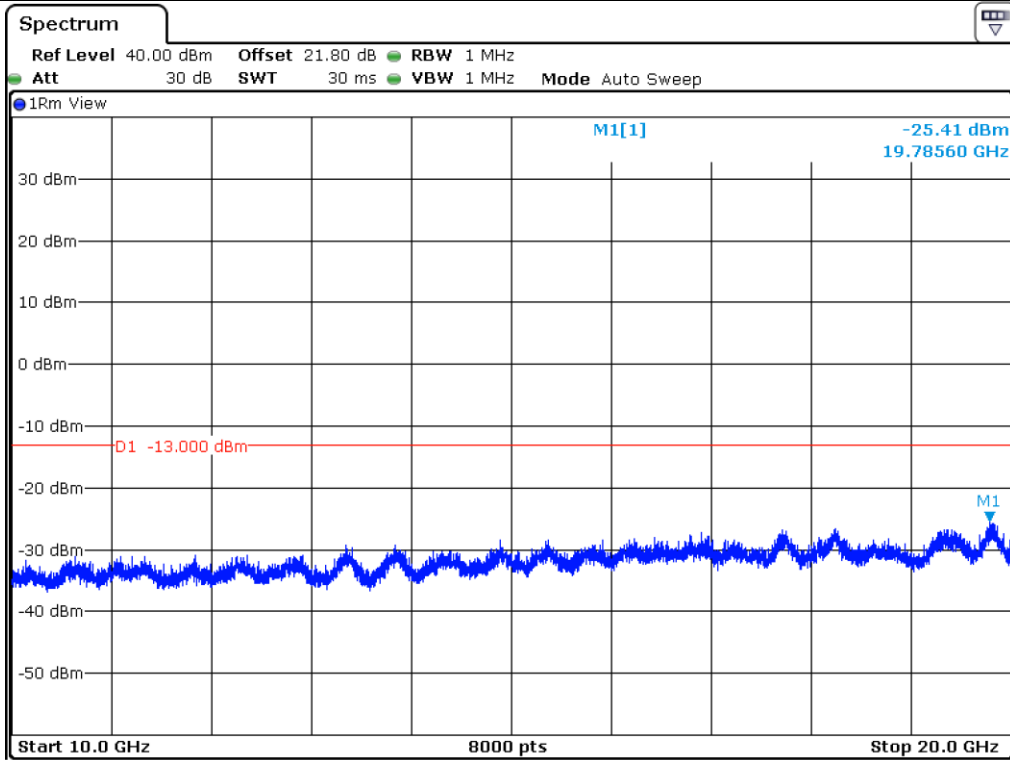


Low Channel

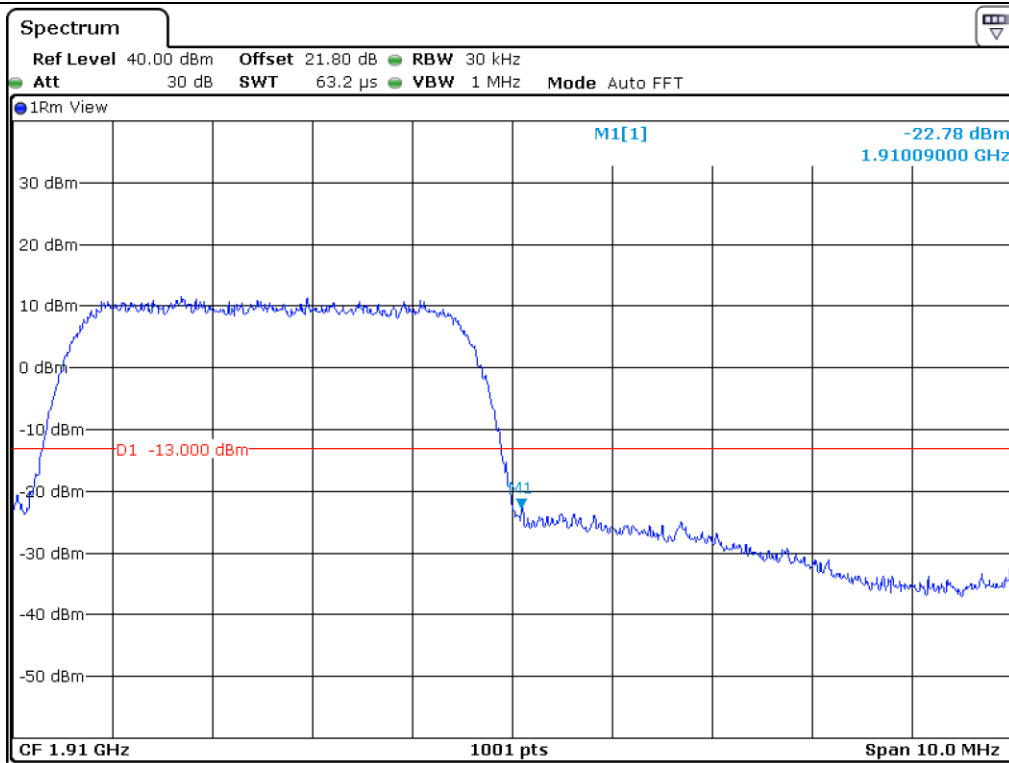




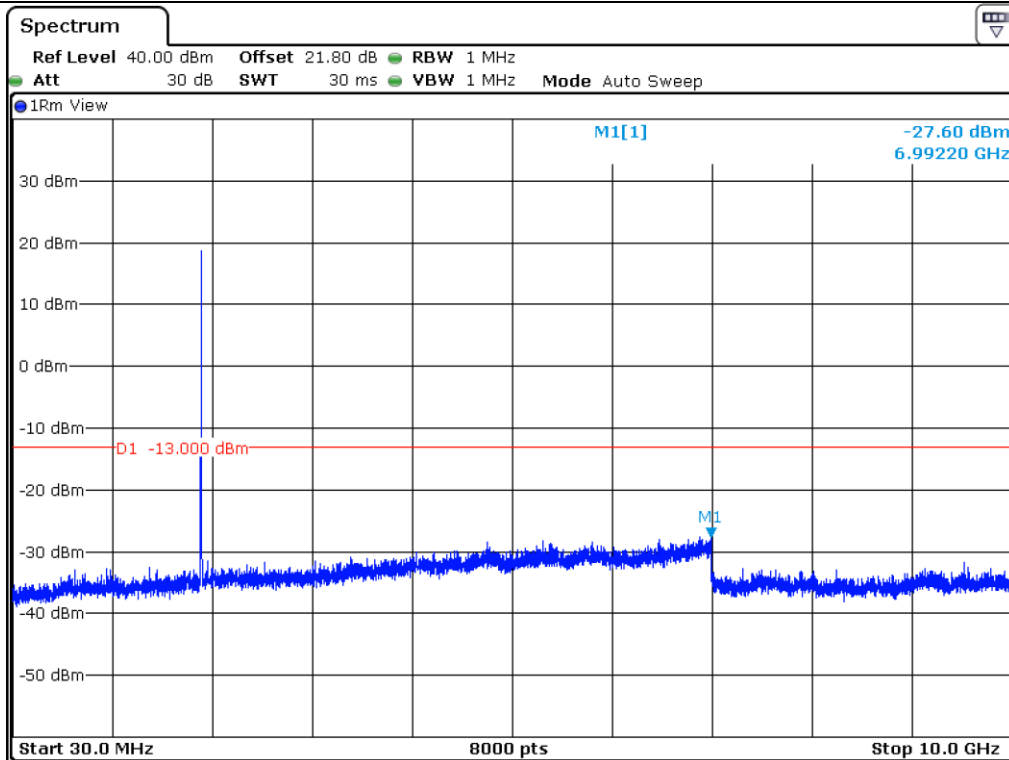
Midle Channel



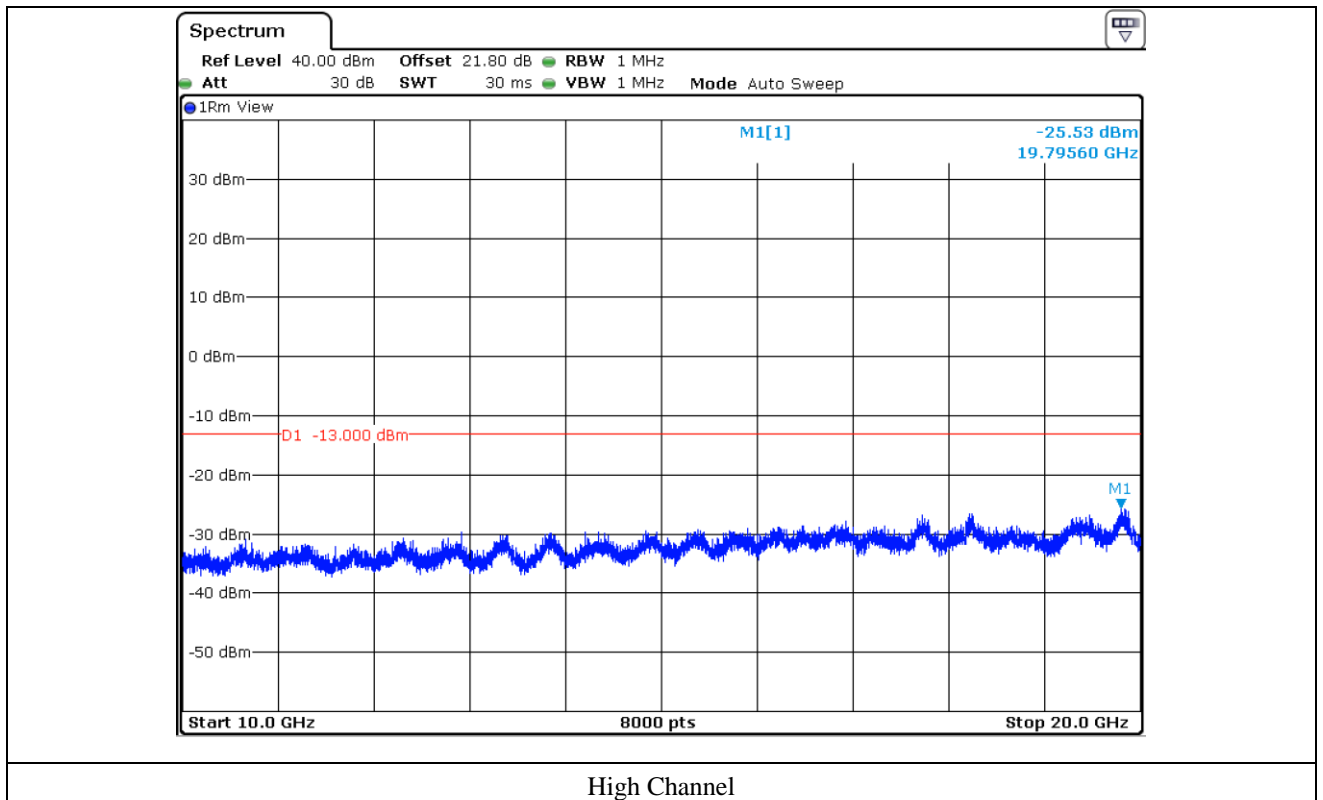
Midle Channel



High Channel



High Channel



14. FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

14.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

14.2 Test set-up

Turn EUT off and set chamber temperature to -30 °C and then allow sufficient time (approximately 20 to 30 minutes after chamber reach the assigned temperature) for EUT to stabilize. Turn ON EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -30 °C to +50 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.

14.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)
■ -	CMW500	Rohde & Schwarz	WIDEBAND RADIO COMMUNICATION TESTER	127298	Mar. 15, 2018 (1Y)
■ -	Directional Coupler	AA-MCS	AAMCS-UDC	400	Aug. 23, 2018 (1Y)
■ -	PSL-2KP	ESPEC	Environmental Test Chamber	14009407	Feb. 23, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

14.4 Test data

14.4.1 Test data for GSM850

Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30	3.70 V	836 600 000	836 599 998	-0.002 4
-20			836 599 996	-0.004 8
-10			836 599 996	-0.004 8
0			836 599 998	-0.002 4
10			836 599 998	-0.002 4
20			836 600 000	0.000 0
30			836 599 999	-0.001 2
40			836 599 995	-0.006 0
50			836 599 995	-0.006 0
20			4.07 V	
20	3.33 V		836 599 996	-0.004 8

14.4.2 Test data for GSM1900


Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30	3.70 V	1 880 000 000	1 879 999 994	-0.003 2
-20			1 879 999 996	-0.002 1
-10			1 879 999 995	-0.002 7
0			1 879 999 996	-0.002 1
10			1 879 999 996	-0.002 1
20			1 880 000 000	0.000 0
30			1 879 999 997	-0.001 6
40			1 879 999 996	-0.002 1
50			1 879 999 998	-0.001 1
20			4.07 V	
20	3.33 V		1 879 999 996	-0.002 1

14.4.3 Test data for WCDMA Band 5

Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30	3.70 V	836 600 000	836599996	-0.004 8
-20			836599995	-0.006 0
-10			836599998	-0.002 4
0			836599997	-0.003 6
10			836599998	-0.002 4
20			836600000	0.000 0
30			836599997	-0.003 6
40			836599996	-0.004 8
50			836599997	-0.003 6
20			4.07 V	
20	3.33 V		836599996	-0.004 8

14.4.4 Test data for WCDMA Band 2

Temperature(° C)	Power(VDC)	Center Freq.	Measured Freq.	PPM
-30	3.70 V	1 880 000 000	1 879 999 994	-0.003 2
-20			1 879 999 995	-0.002 7
-10			1 879 999 994	-0.003 2
0			1 879 999 996	-0.002 1
10			1 879 999 997	-0.001 6
20			1 880 000 000	0.000 0
30			1 879 999 995	-0.002 7
40			1 879 999 996	-0.002 1
50			1 879 999 993	-0.003 7
20			4.07 V	
20	3.33 V		1 879 999 997	-0.001 6



Tested by: Ha-Ram, Lee / Assistant Manager

15. CONDUCTED EMISSION TEST

15.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

15.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

15.3 Test equipment used

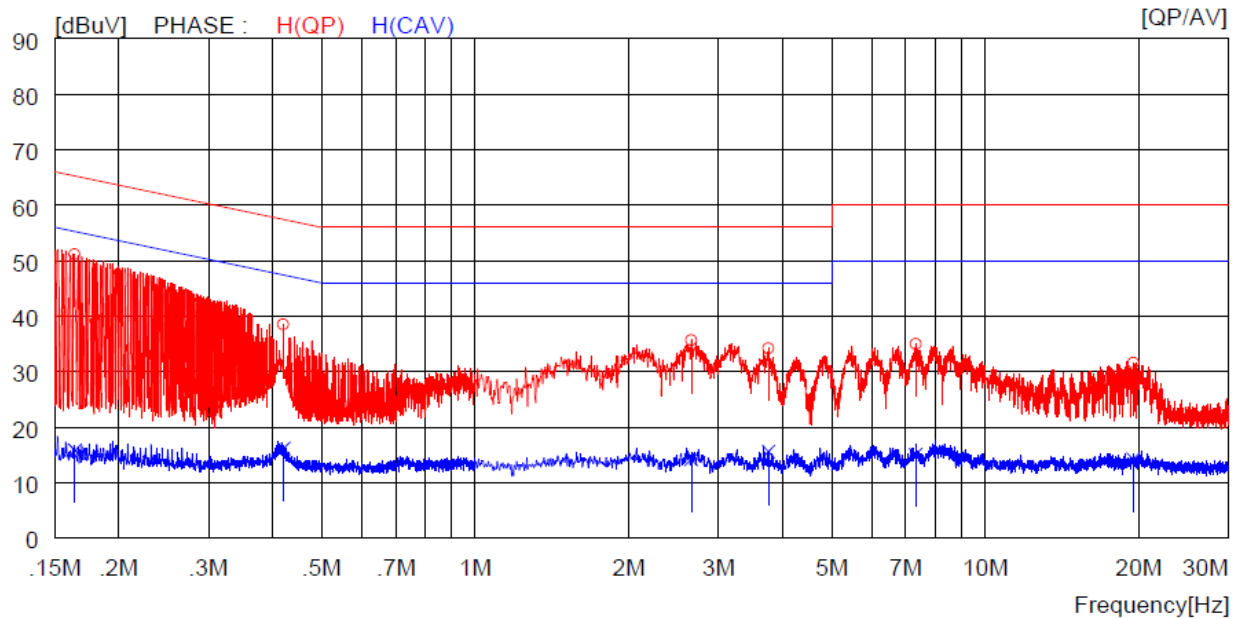
	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012 ce 1	Oct. 27, 2017 (1Y)
□ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101278 ce 2	Oct. 27, 2017 (1Y)
□ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	Mar. 29, 2017 (1Y)
■ -	NSLK8128	Schwarzbeck	AMN	8128-216 ce1	Mar. 28, 2018 (1Y)
□ -	NSLK8126	Schwarzbeck	AMN	8126-404 ce2	Apr. 04, 2018 (1Y)
□ -	NSLK8126	Schwarzbeck	AMN	8126-479 ce2	Oct. 24, 2017 (1Y)
□ -	NNBM 8124	SCHWARZ BECK	V-LISN	05066	Oct. 24, 2017 (1Y)
□ -	NNBM 8124	SCHWARZ BECK	V-LISN	05019	Oct. 25, 2017 (1Y)
■ -	3825/2	EMCO	LISN	9109-1869 ce1	Apr. 11, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

15.4 Test data

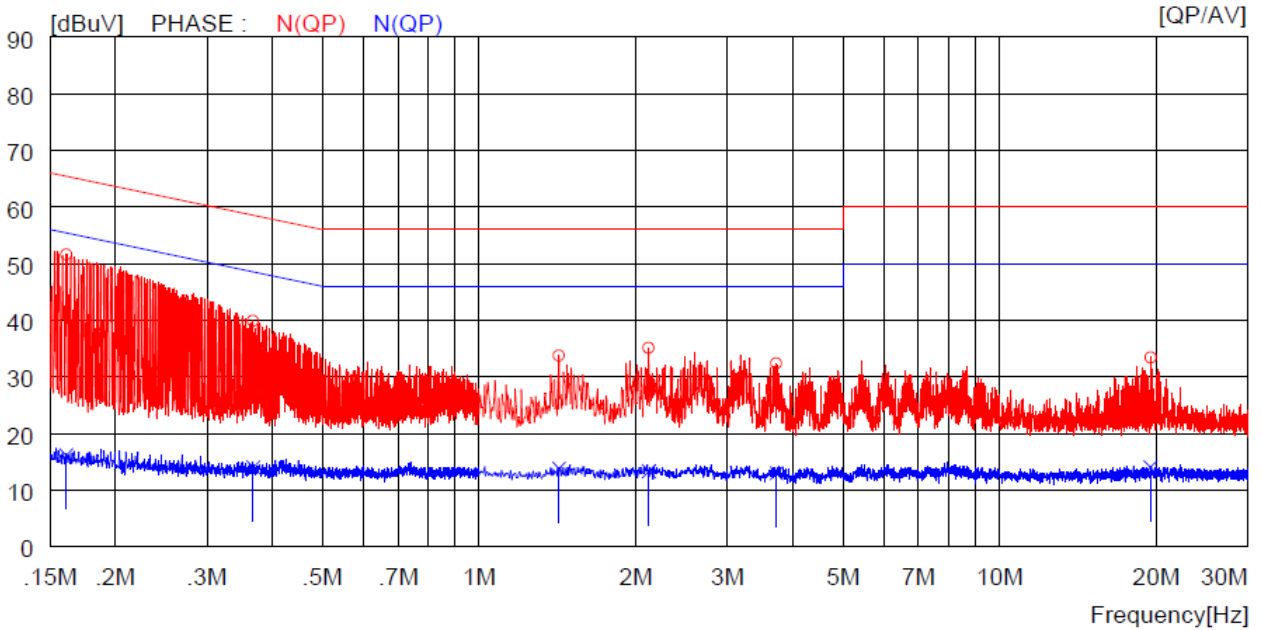
15.4.1 Test data for GSM850

- Test Date : July 16, 2018 ~ August 14, 2018
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.16400	41.3	----	9.9	51.2	----	65.3	----	14.1	----	H (QP)
2	0.42100	28.5	----	10.0	38.5	----	57.4	----	18.9	----	H (QP)
3	2.65200	25.7	----	10.0	35.7	----	56.0	----	20.3	----	H (QP)
4	3.76000	24.1	----	10.1	34.2	----	56.0	----	21.8	----	H (QP)
5	7.31000	24.9	----	10.1	35.0	----	60.0	----	25.0	----	H (QP)
6	19.53000	21.3	----	10.3	31.6	----	60.0	----	28.4	----	H (QP)
7	0.16400	----	6.0	9.9	----	15.9	----	55.3	----	39.4	H (CAV)
8	0.42100	----	6.2	10.0	----	16.2	----	47.4	----	31.2	H (CAV)
9	2.65200	----	4.2	10.0	----	14.2	----	46.0	----	31.8	H (CAV)
10	3.76000	----	5.5	10.1	----	15.6	----	46.0	----	30.4	H (CAV)
11	7.31000	----	5.0	10.1	----	15.1	----	50.0	----	34.9	H (CAV)
12	19.53000	----	4.0	10.3	----	14.3	----	50.0	----	35.7	H (CAV)

-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.16100	41.7	----	9.9	51.6	----	65.4	----	13.8	----	N (QP)
2	0.36800	30.0	----	9.9	39.9	----	58.5	----	18.6	----	N (QP)
3	1.42400	23.8	----	10.0	33.8	----	56.0	----	22.2	----	N (QP)
4	2.12000	25.1	----	10.0	35.1	----	56.0	----	20.9	----	N (QP)
5	3.72800	22.3	----	10.1	32.4	----	56.0	----	23.6	----	N (QP)
6	19.52000	23.1	----	10.3	33.4	----	60.0	----	26.6	----	N (QP)
7	0.16100	----	6.3	9.9	----	16.2	----	55.4	----	39.2	N (CAV)
8	0.36800	----	4.1	9.9	----	14.0	----	48.5	----	34.5	N (CAV)
9	1.42400	----	3.8	10.0	----	13.8	----	46.0	----	32.2	N (CAV)
10	2.12000	----	3.3	10.0	----	13.3	----	46.0	----	32.7	N (CAV)
11	3.72800	----	2.9	10.1	----	13.0	----	46.0	----	33.0	N (CAV)
12	19.52000	----	3.8	10.3	----	14.1	----	50.0	----	35.9	N (CAV)

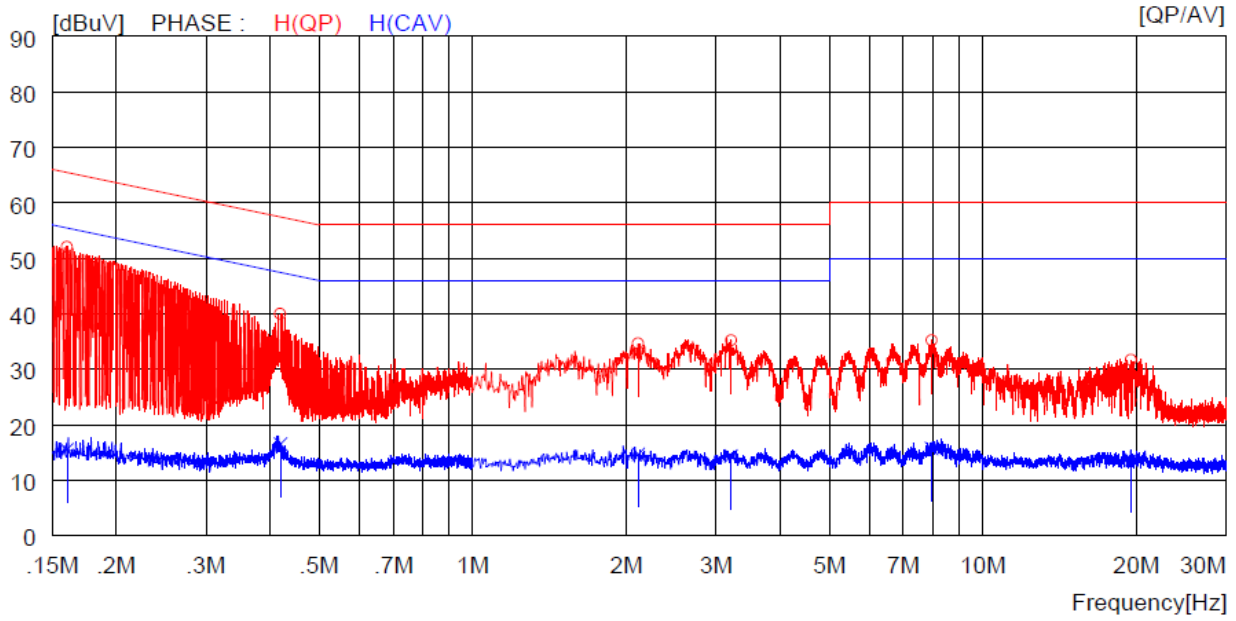
Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Ha-Ram, Lee / Assistant Manager

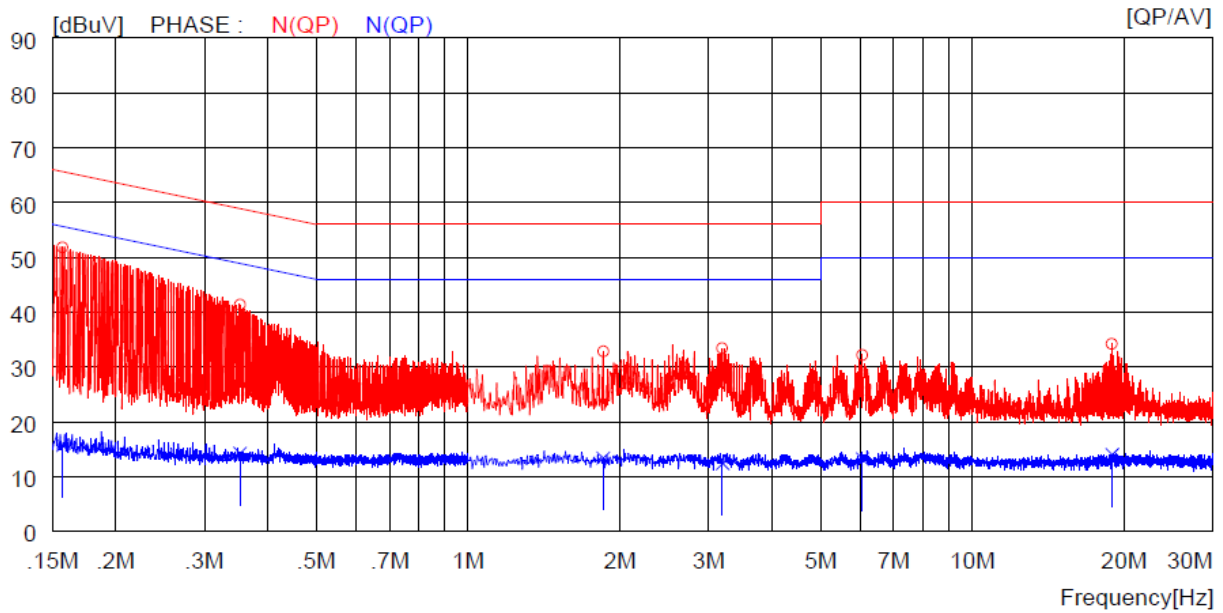
15.4.2 Test data for GSM1900

- Test Date : July 16, 2018 ~ August 14, 2018
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.16000	42.2	----	9.9	52.1	----	65.5	----	13.4	----	H (QP)
2	0.42000	30.0	----	10.0	40.0	----	57.4	----	17.4	----	H (QP)
3	2.11200	24.7	----	10.0	34.7	----	56.0	----	21.3	----	H (QP)
4	3.21200	25.2	----	10.0	35.2	----	56.0	----	20.8	----	H (QP)
5	7.94000	25.1	----	10.1	35.2	----	60.0	----	24.8	----	H (QP)
6	19.56000	21.4	----	10.3	31.7	----	60.0	----	28.3	----	H (QP)
7	0.16000	----	5.6	9.9	----	15.5	----	55.5	----	40.0	H (CAV)
8	0.42000	----	6.5	10.0	----	16.5	----	47.4	----	30.9	H (CAV)
9	2.11200	----	4.7	10.0	----	14.7	----	46.0	----	31.3	H (CAV)
10	3.21200	----	4.4	10.0	----	14.4	----	46.0	----	31.6	H (CAV)
11	7.94000	----	5.6	10.1	----	15.7	----	50.0	----	34.3	H (CAV)
12	19.56000	----	3.4	10.3	----	13.7	----	50.0	----	36.3	H (CAV)

- Test Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.15700	41.9	----	9.9	51.8	----	65.6	----	13.8	----	N (QP)
2	0.35300	31.5	----	9.9	41.4	----	58.9	----	17.5	----	N (QP)
3	1.85600	22.9	----	10.0	32.9	----	56.0	----	23.1	----	N (QP)
4	3.20000	23.4	----	10.0	33.4	----	56.0	----	22.6	----	N (QP)
5	6.06000	22.1	----	10.1	32.2	----	60.0	----	27.8	----	N (QP)
6	18.95000	23.9	----	10.3	34.2	----	60.0	----	25.8	----	N (QP)
7	0.15700	----	5.8	9.9	----	15.7	----	55.6	----	39.9	N (CAV)
8	0.35300	----	4.4	9.9	----	14.3	----	48.9	----	34.6	N (CAV)
9	1.85600	----	3.4	10.0	----	13.4	----	46.0	----	32.6	N (CAV)
10	3.20000	----	2.4	10.0	----	12.4	----	46.0	----	33.6	N (CAV)
11	6.06000	----	3.1	10.1	----	13.2	----	50.0	----	36.8	N (CAV)
12	18.95000	----	3.7	10.3	----	14.0	----	50.0	----	36.0	N (CAV)

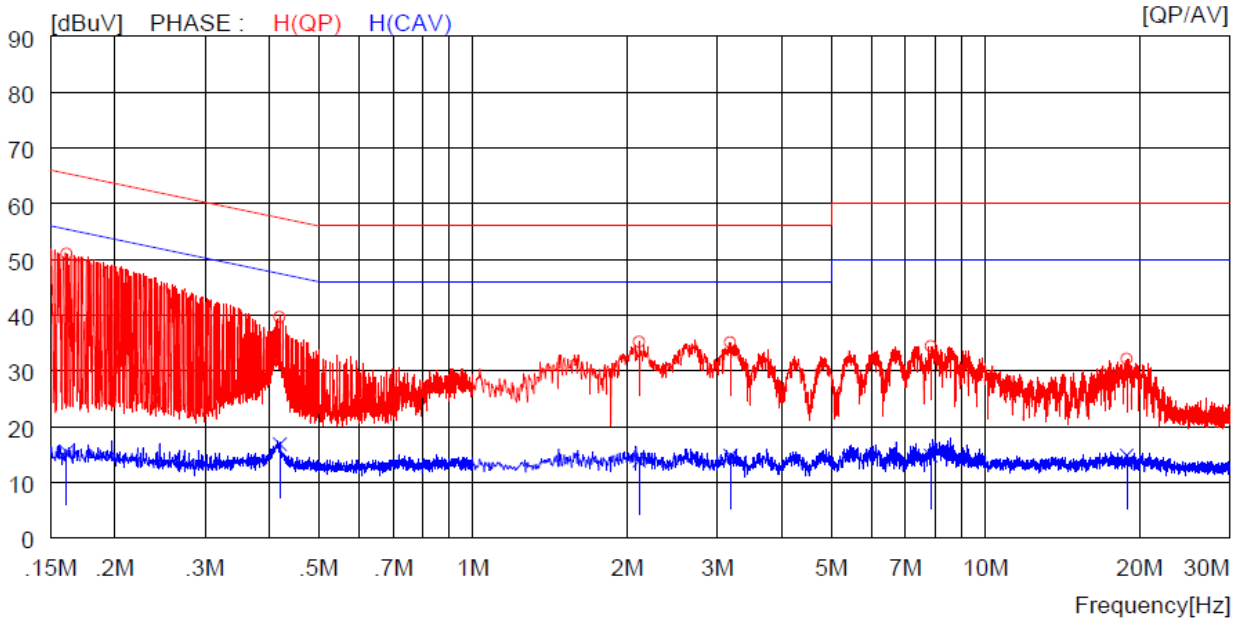
Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

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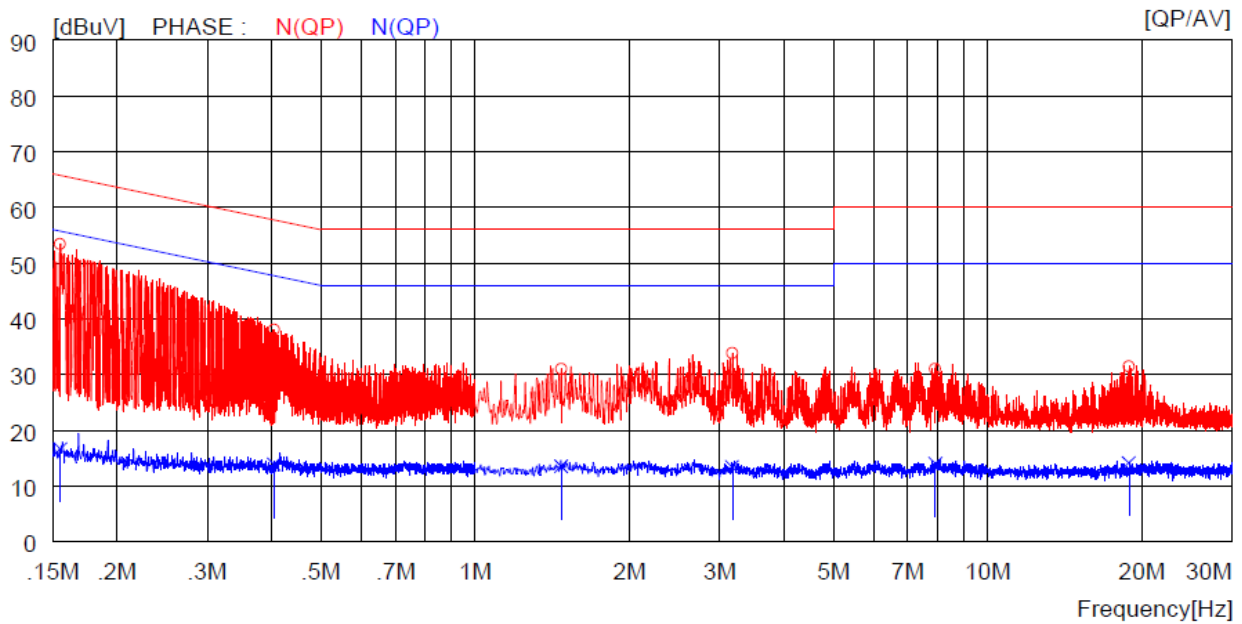
15.4.3 Test data for WCDMA Band 5

- Test Date : July 16, 2018 ~ August 14, 2018
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.16100	41.1	----	9.9	51.0	----	65.4	----	14.4	----	H (QP)
2	0.42000	29.7	----	10.0	39.7	----	57.4	----	17.7	----	H (QP)
3	2.11200	25.2	----	10.0	35.2	----	56.0	----	20.8	----	H (QP)
4	3.18000	25.1	----	10.0	35.1	----	56.0	----	20.9	----	H (QP)
5	7.83000	24.3	----	10.1	34.4	----	60.0	----	25.6	----	H (QP)
6	18.88000	21.9	----	10.3	32.2	----	60.0	----	27.8	----	H (QP)
7	0.16100	----	5.6	9.9	----	15.5	----	55.4	----	39.9	H (CAV)
8	0.42000	----	6.9	10.0	----	16.9	----	47.4	----	30.5	H (CAV)
9	2.11200	----	3.9	10.0	----	13.9	----	46.0	----	32.1	H (CAV)
10	3.18000	----	4.8	10.0	----	14.8	----	46.0	----	31.2	H (CAV)
11	7.83000	----	4.7	10.1	----	14.8	----	50.0	----	35.2	H (CAV)
12	18.88000	----	4.5	10.3	----	14.8	----	50.0	----	35.2	H (CAV)

- Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.15500	43.5	----	9.9	53.4	----	65.7	----	12.3	----	N (QP)
2	0.40500	28.1	----	10.0	38.1	----	57.8	----	19.7	----	N (QP)
3	1.47200	21.0	----	10.0	31.0	----	56.0	----	25.0	----	N (QP)
4	3.17600	23.9	----	10.0	33.9	----	56.0	----	22.1	----	N (QP)
5	7.91000	20.9	----	10.1	31.0	----	60.0	----	29.0	----	N (QP)
6	18.87000	21.2	----	10.3	31.5	----	60.0	----	28.5	----	N (QP)
7	0.15500	----	6.8	9.9	----	16.7	----	55.7	----	39.0	N (CAV)
8	0.40500	----	3.9	10.0	----	13.9	----	47.8	----	33.9	N (CAV)
9	1.47200	----	3.6	10.0	----	13.6	----	46.0	----	32.4	N (CAV)
10	3.17600	----	3.5	10.0	----	13.5	----	46.0	----	32.5	N (CAV)
11	7.91000	----	4.0	10.1	----	14.1	----	50.0	----	35.9	N (CAV)
12	18.87000	----	3.9	10.3	----	14.2	----	50.0	----	35.8	N (CAV)

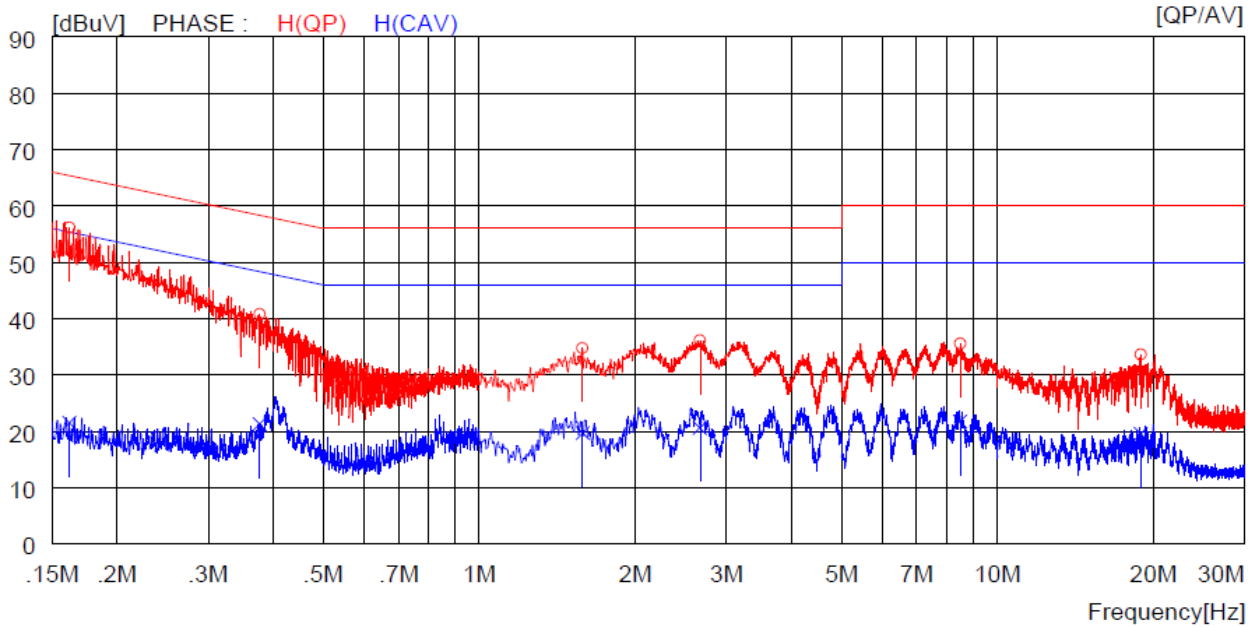
Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

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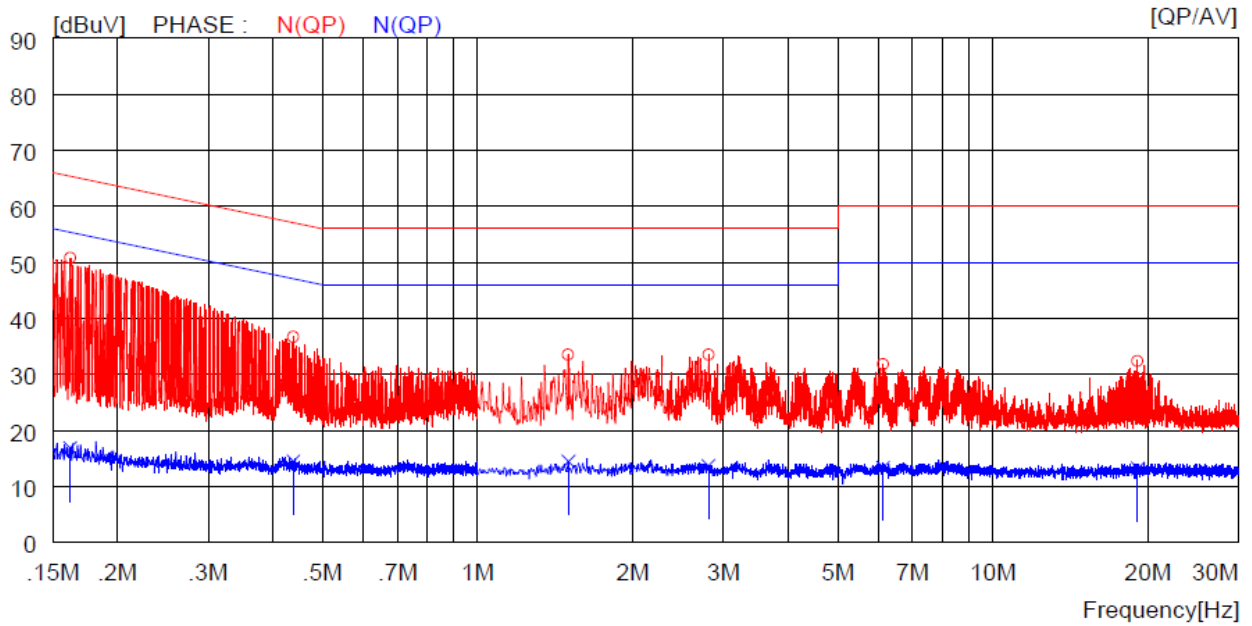
15.4.4 Test data for WCDMA Band 2

- Test Date : July 16, 2018 ~ August 14, 2018
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.16200	46.2	----	9.9	56.1	----	65.4	----	9.3	----	H (QP)
2	0.37700	30.8	----	10.0	40.8	----	58.3	----	17.5	----	H (QP)
3	1.58400	24.8	----	10.0	34.8	----	56.0	----	21.2	----	H (QP)
4	2.66800	26.1	----	10.0	36.1	----	56.0	----	19.9	----	H (QP)
5	8.48000	25.5	----	10.1	35.6	----	60.0	----	24.4	----	H (QP)
6	18.92000	23.3	----	10.3	33.6	----	60.0	----	26.4	----	H (QP)
7	0.16200	----	11.6	9.9	----	21.5	----	55.4	----	33.9	H (CAV)
8	0.37700	----	11.3	10.0	----	21.3	----	48.3	----	27.0	H (CAV)
9	1.58400	----	9.7	10.0	----	19.7	----	46.0	----	26.3	H (CAV)
10	2.66800	----	10.6	10.0	----	20.6	----	46.0	----	25.4	H (CAV)
11	8.48000	----	11.7	10.1	----	21.8	----	50.0	----	28.2	H (CAV)
12	18.92000	----	9.3	10.3	----	19.6	----	50.0	----	30.4	H (CAV)

-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.16200	40.9	----	9.9	50.8	----	65.4	----	14.6	----	N(QP)
2	0.43900	26.7	----	10.0	36.7	----	57.1	----	20.4	----	N(QP)
3	1.50000	23.5	----	10.0	33.5	----	56.0	----	22.5	----	N(QP)
4	2.80800	23.5	----	10.0	33.5	----	56.0	----	22.5	----	N(QP)
5	6.13000	21.7	----	10.1	31.8	----	60.0	----	28.2	----	N(QP)
6	19.11000	22.1	----	10.3	32.4	----	60.0	----	27.6	----	N(QP)
7	0.16200	----	7.0	9.9	----	16.9	----	55.4	----	38.5	N(CAV)
8	0.43900	----	4.5	10.0	----	14.5	----	47.1	----	32.6	N(CAV)
9	1.50000	----	4.5	10.0	----	14.5	----	46.0	----	31.5	N(CAV)
10	2.80800	----	3.7	10.0	----	13.7	----	46.0	----	32.3	N(CAV)
11	6.13000	----	3.3	10.1	----	13.4	----	50.0	----	36.6	N(CAV)
12	19.11000	----	2.9	10.3	----	13.2	----	50.0	----	36.8	N(CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Ha-Ram, Lee / Assistant Manager