ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	DENSO International America, Inc. 2251 Rutherford Rd., Suite 100, Carlsbad, CA. 92008
Product Name:	V2X On-Board Unit
Brand Name:	DENSO
Model No.:	Hercules H7.1E
Model Difference:	N/A
Report Number:	ER/2021/50133
FCC ID	LXC-V2X-OBU-HERC
Issue Date:	August 10, 2021
Date of Test:	May 31, 2021 ~ July 29, 2021
Date of EUT Received:	May 21, 2021

Approved By _____
Blue Yang

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI ANSI C63.26-2015 and the energy emitted by the sample EUT comply with FCC rule part 2.

The results of this report relate only to the sample identified in this report.

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Revision History

Report Number	Revision	Description	Issue Date	Revised By
ER/2021/50133	00	Original	August 10, 2021	Yuri Tsai

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1 GENERAL PRODUCT INFORMATION

1.1 Product Description

Product Name:	V2X On-Board Unit
Brand Name:	DENSO
Model No.:	Hercules H7.1E
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	U12QL1800006C01
Power Supply:	DC 12V

1.2 Operation Frequency Range

Operating Frequency (MHz)			
GSM/GPRS/EDGE 850	824.2	-	848.8
GSM/GPRS/EDGE 1900	1850.2	-	1909.8

Operating Frequency (MHz)			
WCDMA / HSPA+ Band II	1852.4	-	1907.6
WCDMA / HSPA+ Band IV	1712.4	-	1752.6
WCDMA / HSPA+ Band V	826.4	-	846.6

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1.3 Antenna Designation

Antenna Type	Antenna Model No.
Dipole	ANT-LTE-WS-SMA
Note: Transmission in frequencies in this test report are only available by the above antenna(s).	

Modulation	Frequency (MHz)	Peak Antenna Gain (dBi) w cable loss	Peak Antenna Gain (dBi) w/o cable loss
GSM/GPRS/EDGE 850	824.2 - 848.8	1.59	4.09
GSM/GPRS/EDGE 1900	1850.2 - 1909.8	1.76	5.86
WCDMA / HSPA+ Band II	1852.4 - 1907.6	1.76	5.86
WCDMA / HSPA+ Band IV	1712.4 - 1752.6	1.76	5.86
WCDMA / HSPA+ Band V	826.4 - 846.6	1.59	4.09

Note: *1. Antenna information is provided by the applicant.*
2. Cable length 10ft, cable model: RG-174.
3. The measurements were demonstrated by using the antenna gain with cable loss as the worst case scenarios.

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1.4 Type of Emission & Max ERP/EIRP Power Measurement Result:

	ERP / EIRP (dBm)		W	99%	Type of Emission
GSM 850	31.62	ERP	1.452	0.2411	241KGXW
GPRS 850	31.72	ERP	1.486	0.2463	246KGXW
EDGE 850	26.73	ERP	0.471	0.2475	247KG7W
GSM 1900	30.68	EIRP	1.169	0.2397	240KGXW
GPRS 1900	31.62	EIRP	1.452	0.2494	249KGXW
EDGE 1900	27.88	EIRP	0.614	0.2506	251KG7W

	ERP / EIRP (dBm)		W	99%	Type of Emission
WCDMA Band II	24.67	EIRP	0.293	4.1479	4M15F9W
HSDPA Band II	23.75	EIRP	0.237	4.1434	4M14F9W
HSUPA Band II	24.00	EIRP	0.251	4.1401	4M14F9W
WCDMA Band IV	25.29	EIRP	0.338	4.1299	4M13F9W
HSDPA Band IV	24.07	EIRP	0.255	4.1268	4M13F9W
HSUPA Band IV	24.26	EIRP	0.267	4.1270	4M13F9W
WCDMA Band V	22.16	ERP	0.164	4.1234	4M12F9W
HSDPA Band V	21.06	ERP	0.128	4.1287	4M13F9W
HSUPA Band V	20.87	ERP	0.122	4.1248	4M12F9W

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1.5 Test Methodology of Applied Standards

FCC 47 CFR Part 2, 22H, 24E, 27C
ANSI C63.26-2015

KDB971168 D01 Power Meas license Digital System v03r01

KDB941225 D01 SAR test for 3G devices v03r01 (SAR Measurement Procedures for 3G Devices, WCDMA / HSPA) was used for EUT and Base station setting.

KDB412172 D01 Determining ERP and EIRP v01r01

TS 151 010-1 is used to set, and measure the output power.

1.6 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
		Conducted 6		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction A	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

1.7 Special Accessories

No special accessories were used during testing.

1.8 Equipment Modifications

There was no modifications incorporated into the EUT.

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1.9 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*9m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT (Transmitter) was operated in the continuous transmission mode employed with the simulator of the Base Station that fixates at test default channels to fix the Tx frequency which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Measurement at Antenna Port

The EUT is placed on a table which is 0.8 m above ground plane. A low loss of RF cable was used to connect the antenna port of EUT to measurement equipment.

2.3.2 Radiated Emissions (ERP/EIRP)

The EUT is placed on a turn table, for emission measurements below 1 GHz is 0.8 m above ground plane, for emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both Horizontal and Vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

For all conducted test items:
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.
Note:
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Following shows an offset computation in physical test.

	RF cable loss (dB)	Attenuation factor(dB)	offset(dB)
Low Band (Below 1GHz)	3.8	10	13.8
High Band (Above 1 GHz)	3.7	10	13.7

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2.5 Final Amplifier Voltage and Current Information:

Test Mode	DC voltage (V)	DC current (mA)
GSM 850	12	920
GSM 1900		796
WCDMA/HSPA Band II		821
WCDMA/HSPA Band IV		893
WCDMA/HSPA Band V		896

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2.6 Configuration of Tested System

Fig. 2-1 Configuration of Tested System (Fixed Channel-Conducted)

2G/3G

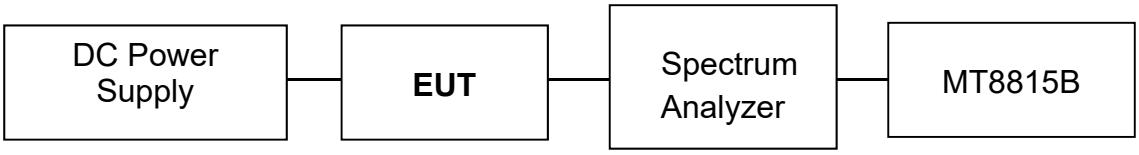
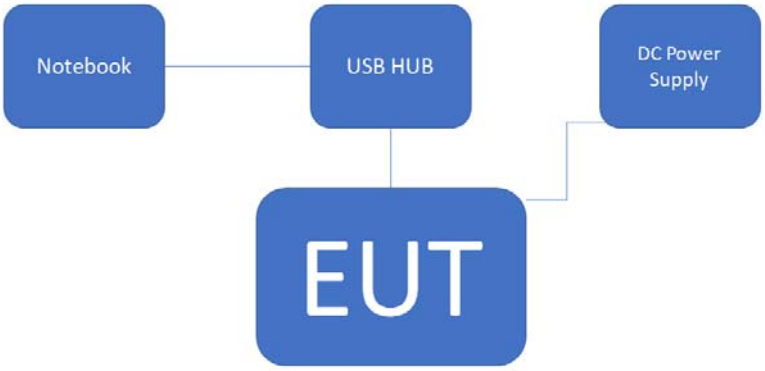


Fig. 2-2 Configuration of Tested System (Fixed Channel-Radiated)



Remote Side

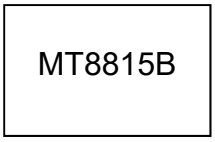


Table 2-1 Equipment Used in

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	Radio Communication Analyer	Anritsu	MT8815B	6200711454	N/A	N/A
2.	DC Power Supply	Agilent	E3640A	MY52410006	N/A	N/A
3.	Notebook	Lenovo	L480	PF-1S9NT5	N/A	N/A
4.	4Ports USB HUB	Samrt	HB-560	20080701	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§2.1046(a)	RF Power Output	Compliant
§22.913(a)(5) §24.232(c) §27.50(d)(4)	ERP/ EIRP measurement	Compliant
§2.1049(h)	99% & 26dB Occupied Bandwidth	Compliant
§2.1051 §22.917(a)(b) §24.238(a) §27.53(h)	Out of Band Emissions at Antenna Terminals and Band Edge / Emission mask requirements	Compliant
§2.1053 §2.1057(a)(1)§22.917(a) §24.238(a) §27.53(h)	Field Strength of Spurious Radiation	Compliant
§24.232(d) §27.50(a)(1)(B)	Peak to Average Ratio	Compliant
§2.1055(a)(1) §22.355 §24.235 §27.54	Frequency Stability	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, X(E1)Y(E2)Z(H) axis and antenna ports. The worst case was found as listed below. Following channel(s) was (were) selected for the final test as listed below:

BAND	H Plane	E1 Plane	E2 Plane
GSM/GPRS/EDGE 850	V		
GSM/GPRS/EDGE 1900	V		
WCDMA/HSPA Band II	V		
WCDMA/HSPA Band IV	V		
WCDMA/HSPA Band V	V		

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4.2 Measurement Configuration

Test Items	GSM Bands	Test Channel		
		L	M	H
ERP	850	v	v	v
EIRP	1900	v	v	v
FREQUENCY STABILITY	850	-	v	-
	1900	-	v	-
OCCUPIED BANDWIDTH	850	v	v	v
	1900	v	v	v
PEAK TO AVERAGE RATIO	850	v	v	v
	1900	v	v	v
BAND EDGE	850	v	-	v
	1900	v	-	v
CONDCUDETED EMISSION	850	v	v	v
	1900	v	v	v
RADIATED EMISSION	850	v	v	v
	1900	v	v	v

Test Items	WCDMA / HSPA Bands	Test Channel		
		L	M	H
ERP	Band V	v	v	v
EIRP	Bnad II	v	v	v
	Band IV	v	v	v
FREQUENCY STABILITY	Bnad II	-	v	-
	Band IV	-	v	-
	Band V	-	v	-
OCCUPIED BANDWIDTH	Bnad II	v	v	v
	Band IV	v	v	v
	Band V	v	v	v
PEAK TO AVERAGE RATIO	Bnad II	v	v	v
	Band IV	v	v	v
	Band V	v	v	v
BAND EDGE	Bnad II	v	-	v
	Band IV	v	-	v
	Band V	v	-	v
CONDCUDETED EMISSION	Bnad II	v	v	v
	Band IV	v	v	v
	Band V	v	v	v
RADIATED EMISSION	Bnad II	v	v	v
	Band IV	v	v	v
	Band V	v	v	v

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty		
RF Power Output	+/-	1	dB
ERP/ EIRP measurement	+/-	3	dB
	+/-	3	dB
Emission Bandwidth	+/-	1.53	Hz
Out of Band Emissions at Antenna Terminals and Band Edge	+/-	1.69	dB
Peak to Average Ratio	+/-	1	dB
Frequency Stability vs. Temperature	+/-	1.53	Hz
Frequency Stability vs. Voltage	+/-	1.53	Hz
Temperature	+/-	0.4	°C
Humidity	+/-	3.5	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty				
Polarization: Vertical	**+/-**	**2.64**	**dB**	9kHz~30MHz
	+/-	**4.93**	**dB**	30MHz - 1000MHz
	+/-	**4.81**	**dB**	1GHz - 18GHz
	+/-	**4.52**	**dB**	18GHz - 40GHz
Polarization: Horizontal	**+/-**	**2.64**	**dB**	9kHz~30MHz
	+/-	**4.45**	**dB**	30MHz - 1000MHz
	+/-	**4.81**	**dB**	1GHz - 18GHz
	+/-	**4.52**	**dB**	18GHz - 40GHz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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6 MAXMUM OUTPUT POWER

6.1 Standard Applicable

A base station simulator was used to establish communication with the EUT. Its parameters were set to transmit the maximum power on the EUT. The measured power in the radio frequency on the transmitter output terminals.

According to FCC §2.1046

FCC 22.913(a)

(5) mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

FCC 24.232(c)

Mobile and portable stations are limited to 2 W EIRP.

FCC 27.50(d)

(4) Mobile, and portable (hand-held) stations operating in the 1710-1755 MHz, 1695-1710 MHz and 1755-1780 MHz bands are limited to 1W EIRP.

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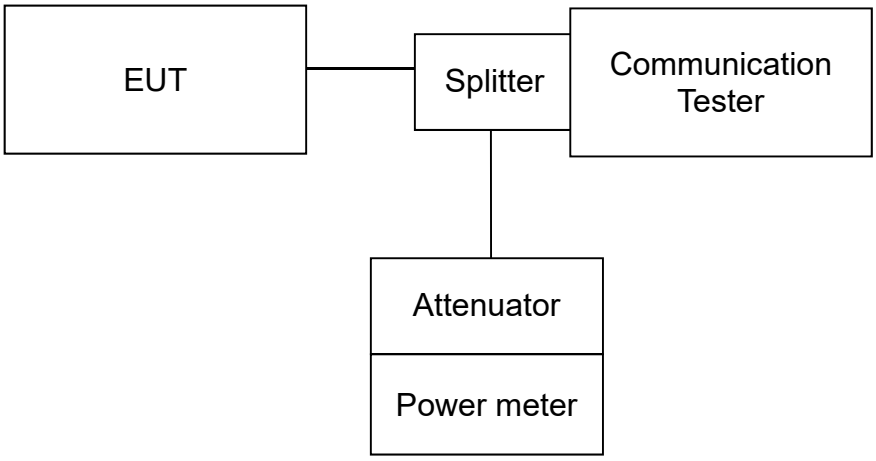
6.2 Test Set-up



Note: *Measurement setup for testing on Antenna connector*

6.3 Output Power Measurement Applicable Guideance

The transmitter output was connected to a calibrated attenuator, the other end of which was connected to a power meter.

Transmitter output was read off the power meter in dBm.

The power output at the transmitter antenna port was determined by adding the value of the attenuator to the power meter reading.

TS 151 010-1 is reference to conduct the test measurement of output power.

The Procedure of KDB941225 (SAR Measurement Procedures for 3G devices, (WCDMA/HSPA) was used for EUT and RMC 12.2kps is used for Base station setting.

KDB 971168 D01 Power Meas License Digital System as the supplemental test methodology to adjust the proper setting obtaining the measurement results.

Conducted average power is obtained from the simulator telecommunication test set.

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6.4 Determining ERP and/or EIRP from conducted RF output power measurements

According to KDB 412172 D01 Power Approach,

$EIRP = P_T + G_T - L_C$,

$ERP = EIRP - 2.15$,

Where:

ERP or EIRP = effective radiated power or equivalent isotropically radiated power (expressed in the same units as PT, typically dBW, dBm, or power spectral density (PSD)2), relative to either a dipole antenna (ERP) or an isotropic antenna (EIRP);

P_T = transmitter output power, expressed in dBW, dBm, or PSD;

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

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

6.5 Measurement Equipment Used

Conducted Emission Test Site: Conducted 4					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Radio Communication Analyer	Anritsu	MT8815B	6200711454	04/07/2021	04/06/2022
DC Power Supply	Agilent	E3640A	MY52410006	12/17/2020	12/16/2021
Attenuator	Mini-Circuit	BW-S10W2+	2	12/16/2020	12/15/2021

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6.6 GSM Measurement Results

GSM/GPRS/EDGE (GMSK; 8-PSK) Result:

EUT Mode	Freq. (MHz)	CH	Conducted Avg. Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	EIRP (dBm)	Limit (dBm)	Margin (dB)
GSM 850	824.2	128	32.18	1.59	31.62	33.77	38.50	-4.73
	836.6	190	32.14	1.59	31.58	33.73	38.50	-4.77
	848.8	251	32.17	1.59	31.61	33.76	38.50	-4.74
GSM 1900	1850.2	512	28.73	1.76	28.34	30.49	33.00	-2.51
	1880.0	661	28.80	1.76	28.41	30.56	33.00	-2.44
	1909.8	810	28.92	1.76	28.53	30.68	33.00	-2.32
GPRS 850	824.2	128	32.28	1.59	31.72	33.87	38.50	-4.63
	836.6	190	32.25	1.59	31.69	33.84	38.50	-4.66
	848.8	251	32.22	1.59	31.66	33.81	38.50	-4.69
GPRS 1900	1850.2	512	29.49	1.76	29.10	31.25	33.00	-1.75
	1880.0	661	29.77	1.76	29.38	31.53	33.00	-1.47
	1909.8	810	29.86	1.76	29.47	31.62	33.00	-1.38
EDGE 850	824.2	128	27.29	1.59	26.73	28.88	38.50	-9.62
	836.6	190	27.13	1.59	26.57	28.72	38.50	-9.78
	848.8	251	27.27	1.59	26.71	28.86	38.50	-9.64
EDGE 1900	1850.2	512	26.11	1.76	25.72	27.87	33.00	-5.13
	1880.0	661	26.12	1.76	25.73	27.88	33.00	-5.12
	1909.8	810	26.10	1.76	25.71	27.86	33.00	-5.14

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EUT Mode	Frequency (MHz)	CH	Average Burst Power (1DN 1UP) Class 8 (dBm)	Average Burst Power (1DN 2UP) Class 10 (dBm)	Average Burst Power (1DN 3UP) Class 12 (dBm)	Average Burst Power (1DN 4UP) Class 12 (dBm)
GPRS 850	824.2	128	32.28	30.00	27.85	26.56
	836.6	190	32.25	29.94	27.83	26.45
	848.8	251	32.22	29.90	27.80	26.42
GPRS 1900	1850.2	512	29.49	27.34	25.38	24.10
	1880.0	661	29.77	27.40	25.49	24.18
	1909.8	810	29.86	27.47	25.43	24.17
EDGE 850	824.2	128	27.29	24.11	23.47	22.08
	836.6	190	27.13	24.18	23.45	21.73
	848.8	251	27.27	24.03	23.49	22.04
EDGE 1900	1850.2	512	26.11	23.13	21.64	20.11
	1880.0	661	26.12	23.14	21.70	20.45
	1909.8	810	26.10	23.34	21.75	20.74

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6.7 WCDMA & HSPA Measurement Results:

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The EUT supports power Class 3, which has a nominal maximum output power of 24 dBm. RMC 12.2kps is used for this testing.

WCDMA/HSUPA/HSDPA Band II Result:

EUT Mode	Freq. (MHz)	CH	Conducted Avg. Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	EIRP (dBm)	Limit (dBm)	Margin (dB)
WCDMA	1852.4	9262	22.72	1.76	22.33	24.48	33.00	-8.52
	1880.0	9400	22.79	1.76	22.40	24.55	33.00	-8.45
	1907.6	9538	22.91	1.76	22.52	24.67	33.00	-8.33
HSDPA	1852.4	9262	21.80	1.76	21.41	23.56	33.00	-9.44
	1880.0	9400	21.88	1.76	21.49	23.64	33.00	-9.36
	1907.6	9538	21.99	1.76	21.60	23.75	33.00	-9.25
HSUPA	1852.4	9262	22.24	1.76	21.85	24.00	33.00	-9.00
	1880.0	9400	22.19	1.76	21.80	23.95	33.00	-9.05
	1907.6	9538	22.24	1.76	21.85	24.00	33.00	-9.00

WCDMA/HSUPA/HSDPA Band IV Result:

EUT Mode	Freq. (MHz)	CH	Conducted Avg. Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	EIRP (dBm)	Limit (dBm)	Margin (dB)
WCDMA	1712.4	1312	23.37	1.76	22.98	25.13	30.00	-4.87
	1732.6	1413	23.53	1.76	23.14	25.29	30.00	-4.71
	1752.6	1513	23.47	1.76	23.08	25.23	30.00	-4.77
HSDPA	1712.4	1312	22.18	1.76	21.79	23.94	30.00	-6.06
	1732.6	1413	22.31	1.76	21.92	24.07	30.00	-5.93
	1752.6	1513	22.25	1.76	21.86	24.01	30.00	-5.99
HSUPA	1712.4	1312	22.36	1.76	21.97	24.12	30.00	-5.88
	1732.6	1413	22.50	1.76	22.11	24.26	30.00	-5.74
	1752.6	1513	22.41	1.76	22.02	24.17	30.00	-5.83

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WCDMA/HSUPA/HSDPA Band V Result:

EUT Mode	Freq. (MHz)	CH	Conducted Avg. Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	EIRP (dBm)	Limit (dBm)	Margin (dB)
WCDMA	826.4	4132	22.64	1.59	22.08	24.23	38.50	-14.27
	836.6	4183	22.58	1.59	22.02	24.17	38.50	-14.33
	846.6	4233	22.72	1.59	22.16	24.31	38.50	-14.19
HSDPA	826.4	4132	21.62	1.59	21.06	23.21	38.50	-15.29
	836.6	4183	21.52	1.59	20.96	23.11	38.50	-15.39
	846.6	4233	21.60	1.59	21.04	23.19	38.50	-15.31
HSUPA	826.4	4132	21.34	1.59	20.78	22.93	38.50	-15.57
	836.6	4183	21.42	1.59	20.86	23.01	38.50	-15.49
	846.6	4233	21.43	1.59	20.87	23.02	38.50	-15.48

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6.7.1 HSPA (HSDPA & HSUPA) Release 6:

The following 4 Sub-Tests were completed according to the test requirements outlined in section 5.2A of the 3GPP TS34.121-1 specification. All TX RMS power requirements for Power Class 3 were met according to table 5.2AA.5 and 5.2B.5 All UE channels and power ratio's are set according to table C10.1.4 & C11.1.3 in the 3GPP TS34.121-1. RMC 12.2kps is used for this testing.

6.7.2 HSDPA SUB-TEST Setting

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH(FOR HSDPA)

Sub-test	β_c	β_d	β_d ***(SF)***	β_c/β_d	β_{HS} *(Note1, Note 2)*	**CM (dB)** *(Note 3)*	**MPR (dB)** *(Note 3)*	**RMC (Kbps)**
1	2/15	15/15	64	2/15	4/15	0.0	0.0	12.2
2	12/15 *(Note 4)*	15/15 *(Note 4)*	64	12/15 *(Note 4)*	24/15	1.0	0.0	12.2
3	15/15	8/15	64	15/8	30/15	1.5	0.5	12.2
4	15/15	4/15	64	15/4	30/15	1.5	0.5	12.2

Note: *The recommended HSDPA MPRs are implemented as per following sub-tests.*

Mode	Sub test	Avg. Power (dBm) Channel		
		9262.00	9400.00	9538.00
HSDPA II	1	21.80	21.88	21.99
	2	22.07	21.84	22.02
	3	21.42	21.47	21.67
	4	21.33	21.50	21.58

Mode	Sub test	Avg. Power (dBm) Channel		
		1312.00	1413.00	1513.00
HSDPA IV	1	22.18	22.31	22.25
	2	22.08	22.15	22.19
	3	22.04	21.92	21.86
	4	21.82	21.83	21.78

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Mode	Sub test	Avg. Power (dBm) Channel		
		4132.00	4183.00	4233.00
HSDPA V	1	21.62	21.52	21.60
	2	21.54	21.52	21.53
	3	21.01	21.12	20.91
	4	20.94	21.11	20.80

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6.7.3 HSPA SUB-TEST Setting

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH(FOR HSUPA)

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS}	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (Codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI	RMC (Kbps)
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75	12.2
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67	12.2
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92	12.2
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71	12.2
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81	12.2

Note: *The recommended HSUPA MPRs are implemented as per following sub-tests.*

Mode	Sub test	Avg. Power (dBm) Channel		
		9262.00	9400.00	9538.00
HSUPA II	1	22.24	22.19	22.24
	2	21.62	21.68	21.67
	3	22.00	22.03	22.07
	4	22.01	22.00	22.05
	5	22.26	22.18	22.16

Mode	Sub test	Avg. Power (dBm) Channel		
		1312.00	1413.00	1513.00
HSUPA IV	1	22.36	22.50	22.41
	2	21.84	22.10	22.03
	3	22.28	22.44	22.34
	4	22.16	22.27	22.29
	5	22.38	22.41	22.42

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Mode	Sub test	Avg. Power (dBm) Channel		
		4132.00	4183.00	4233.00
HSUPA V	1	21.34	21.42	21.43
	2	21.11	21.07	21.00
	3	21.46	21.57	21.51
	4	21.37	21.54	21.49
	5	21.53	21.66	21.33

6.7.4 WCDMA/HSDPA/HSUPA band II, IV, V

The EUT output power was controlled by simulator and enter max rated power 24dBm. The EUT is going to be set to max output power to 24dBm then record the read. The min. power was measures by a function key “minimum power” then record the read. It is -52.3dBm. The power variation can be 0.1dB step by setting.

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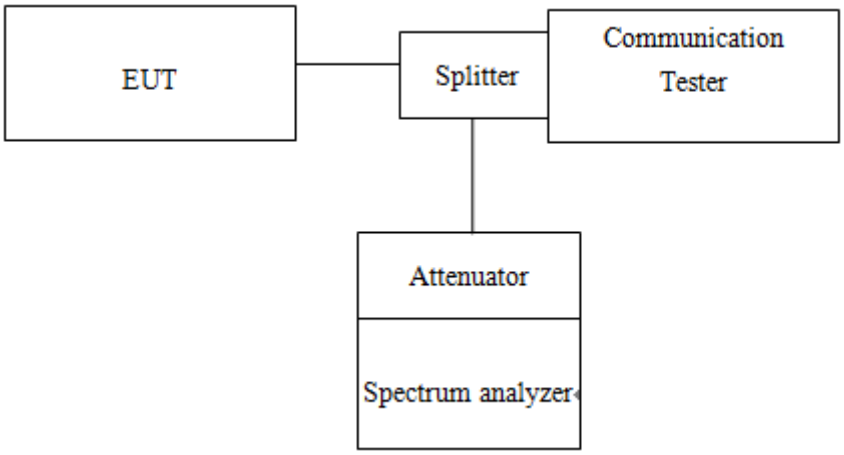
7 OCCUPIED BANDWIDTH MEASUREMENT

7.1 Standard Applicable

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power.

7.2 Test Set-up



7.3 Measurement Procedure

99% &26dB Bandwidth with detector peak

The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW was set to about 1% of emission BW, VBW= 3 times RBW, -26dBc display line was placed on the screen (or 26dB bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace. Then set RBW to 99% bandwidth, RBW= 1%, VBW= 3 * RBW, with span > 2 * Signal BW, set % Power = 99%.

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7.4 Measurement Equipment Used

Conducted Emission Test Site: Conducted 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
Temperature Chamber	Giant Force	GTH-150-40-CP-AR	MAA0512-018	05/19/2021	05/18/2022
Radio Communication Analyer	Anritsu	MT8815B	6200711454	04/07/2021	04/06/2022
DC Power Supply	Agilent	E3640A	MY52410006	12/17/2020	12/16/2021
Attenuator	Mini-Circuit	BW-S10W2+	2	12/16/2020	12/15/2021
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021
Power Divider	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-018	12/16/2020	12/15/2021

7.5 Measurement Result

Freq. (MHz)	CH	99% BW (MHz)			26 dB BW (MHz)		
		GSM 850	GPRS 850	EDGE 850	GSM 850	GPRS 850	EDGE 850
824.2	128	0.24112	0.24577	0.24366	0.3094	0.3130	0.3183
836.6	190	0.23789	0.24634	0.24746	0.3065	0.0000	0.3165
848.8	251	0.23958	0.24411	0.24601	0.3050	0.3156	0.3010

Freq. (MHz)	CH	99% BW (MHz)			26 dB BW (MHz)		
		GSM 1900	GPRS 1900	EDGE 1900	GSM 1900	GPRS 1900	EDGE 1900
1850.2	512	0.23968	0.24397	0.25061	0.3036	0.3209	0.3102
1880.0	661	0.23880	0.24935	0.24569	0.3090	0.3228	0.3162
1909.8	810	0.23940	0.24298	0.24829	0.3069	0.3163	0.3204

Freq. (MHz)	CH	99% BW (MHz)			26 dB BW (MHz)		
		WCDMA II	HSDPA II	HSUPA II	WCDMA II	HSDPA II	HSUPA II
1852.40	9262	4.14630	4.13300	4.13270	4.710	4.697	4.711
1880.00	9400	4.14790	4.14340	4.13770	4.730	4.691	4.692
1907.60	9538	4.14110	4.13230	4.14010	4.751	4.682	4.680

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Freq. (MHz)	CH	99% BW (MHz)			26 dB BW (MHz)		
		WCDMA IV	HSDPA IV	HSUPA IV	WCDMA IV	HSDPA IV	HSUPA IV
1712.40	1312	4.12990	4.12680	4.12700	4.698	4.694	4.692
1732.60	1413	4.12200	4.12030	4.12120	4.687	4.665	4.676
1752.60	1513	4.11950	4.11720	4.11220	4.705	4.671	4.668

Freq. (MHz)	CH	99% BW (MHz)			26 dB BW (MHz)		
		WCDMA V	HSDPA V	HSUPA V	WCDMA V	HSDPA V	HSUPA V
826.40	4132	4.12340	4.12620	4.12440	4.691	4.672	4.678
836.60	4183	4.11750	4.11580	4.11910	4.693	4.678	4.667
846.60	4233	4.11900	4.12870	4.12480	4.686	4.682	4.679

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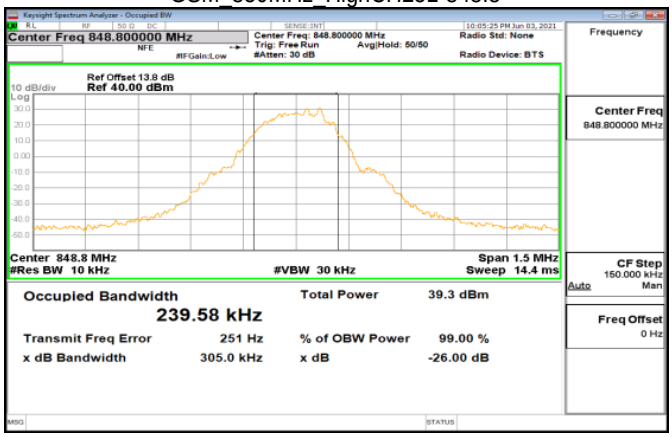
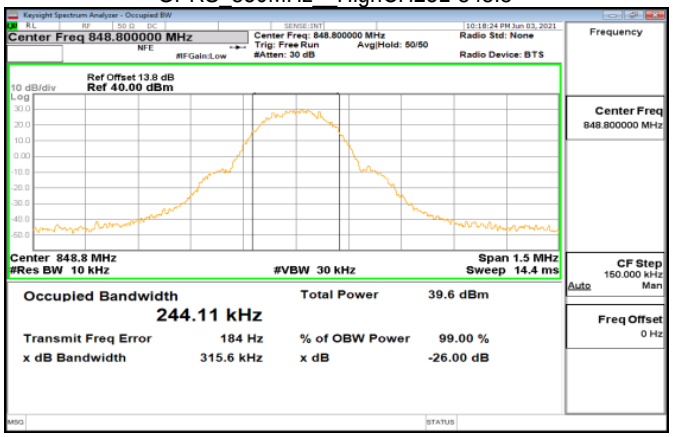
GSM_850MHz_HighCH251-848.8



GPRS_850MHz__HighCH251-848.8



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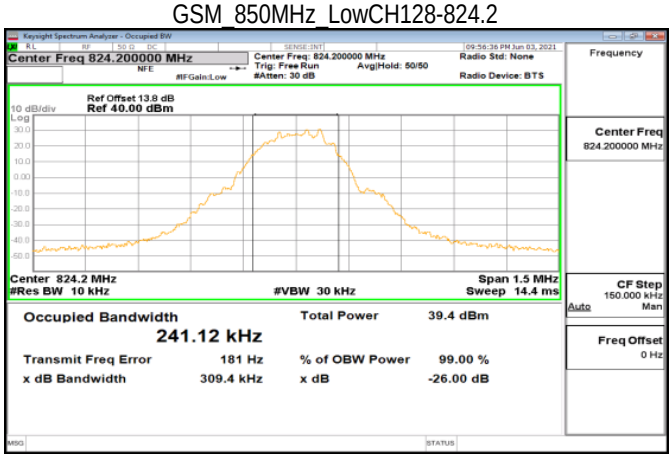

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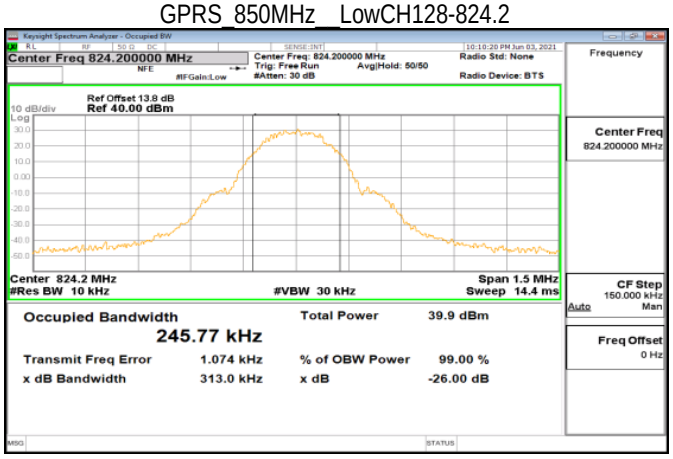

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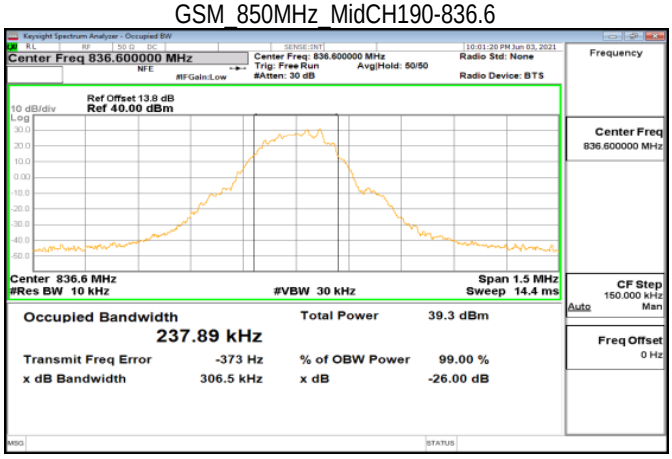

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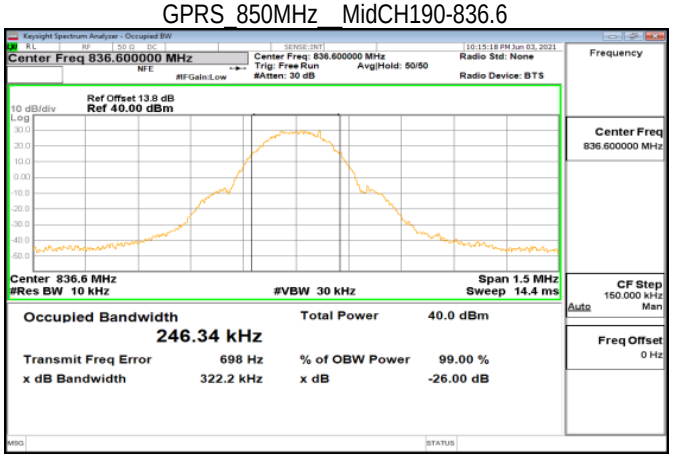

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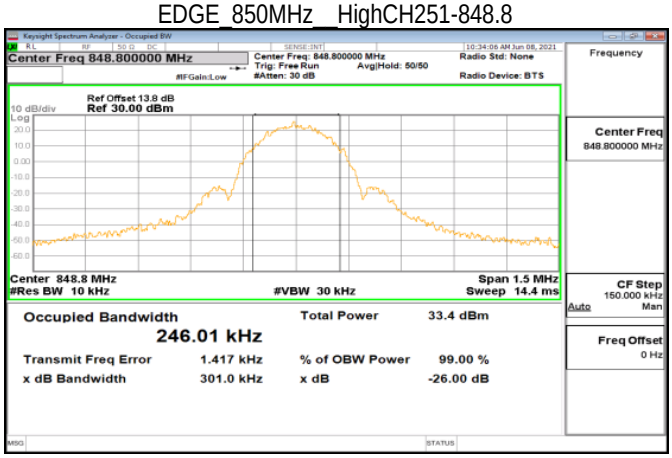
EDGE_850MHz__HighCH251-848.8



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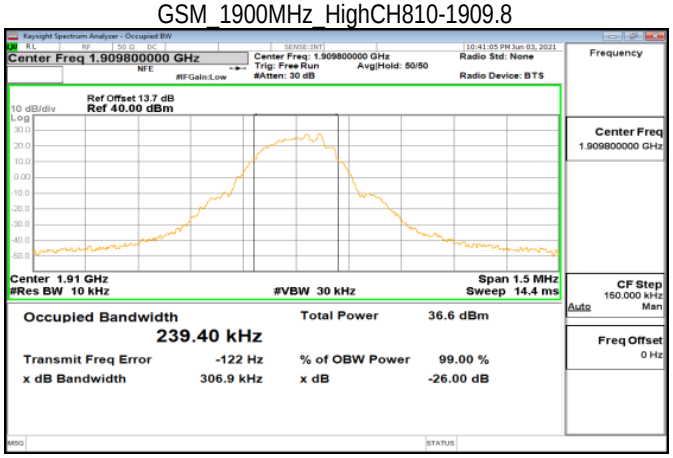
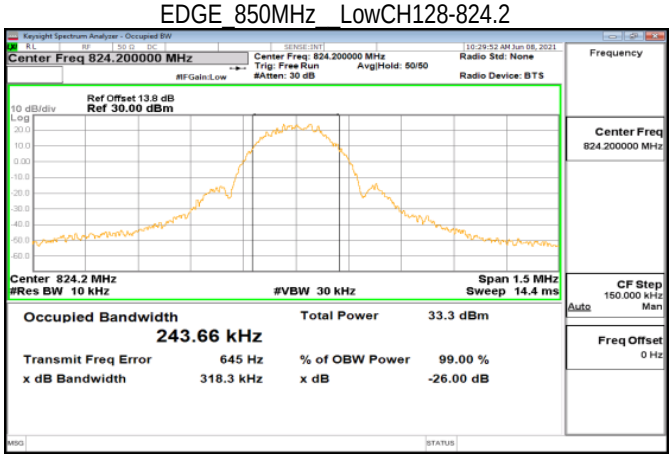
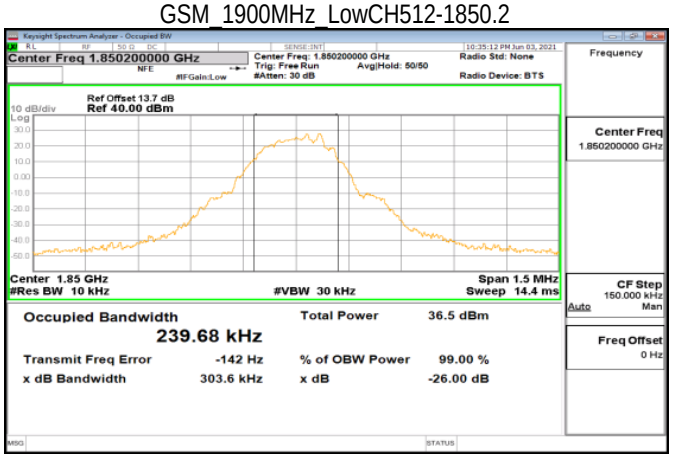


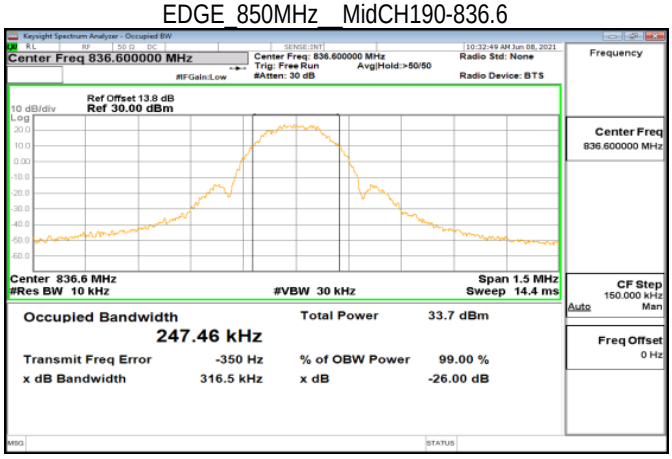
EDGE_850MHz__LowCH128-824.2



GSM_1900MHz_LowCH512-1850.2



EDGE_850MHz__MidCH190-836.6



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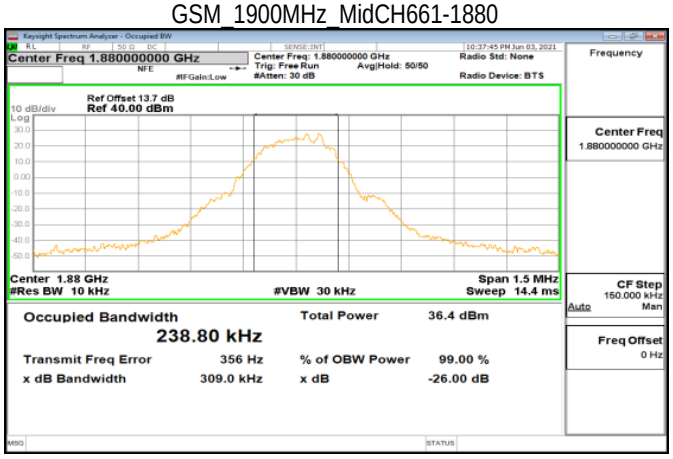

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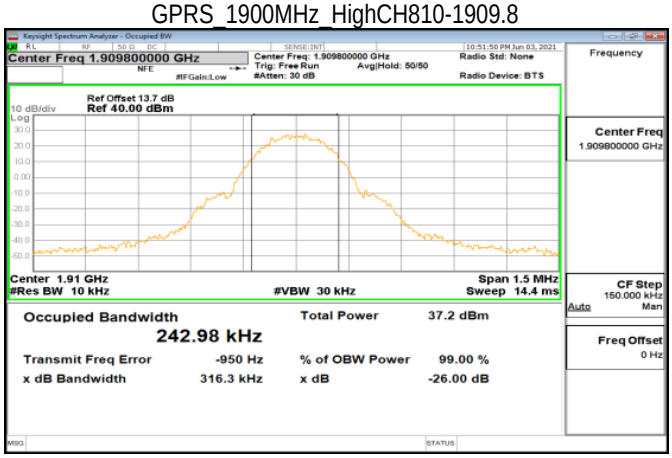
GPRS_1900MHz_HighCH810-1909.8



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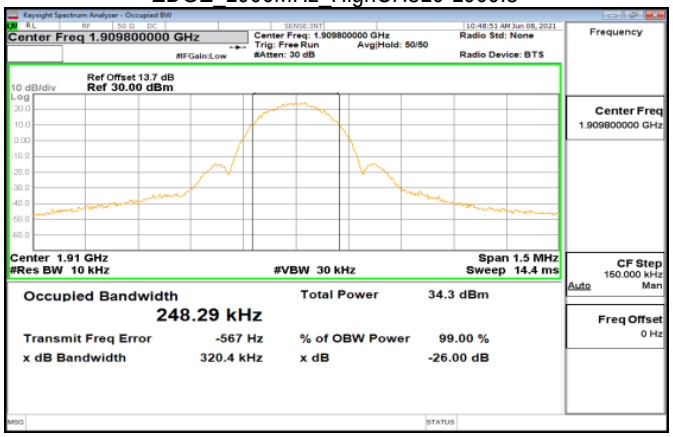

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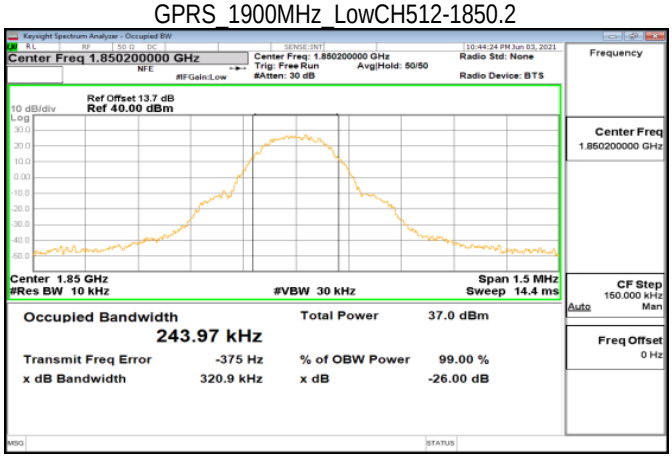

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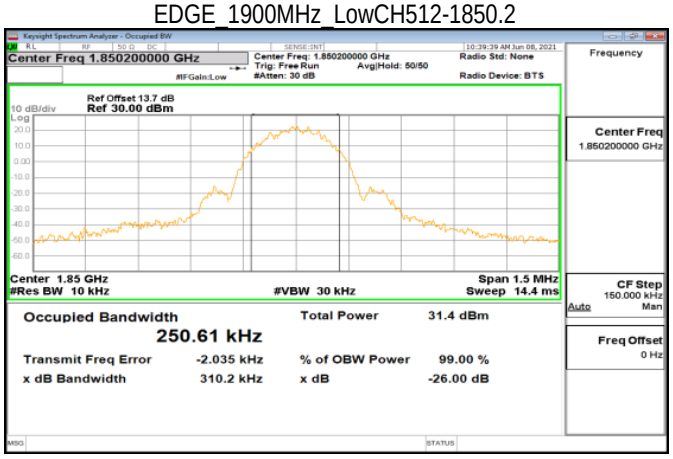

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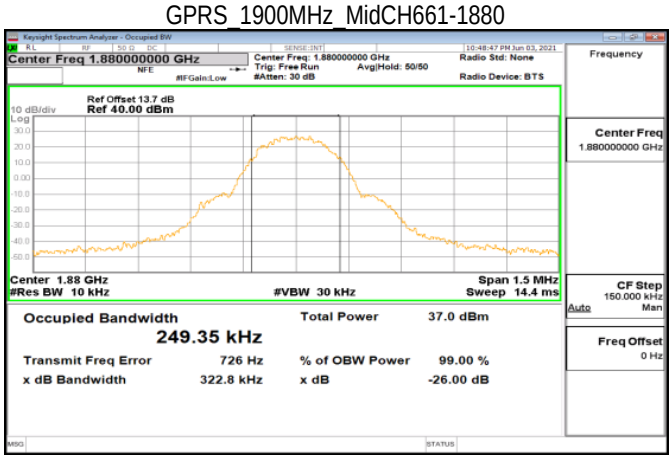

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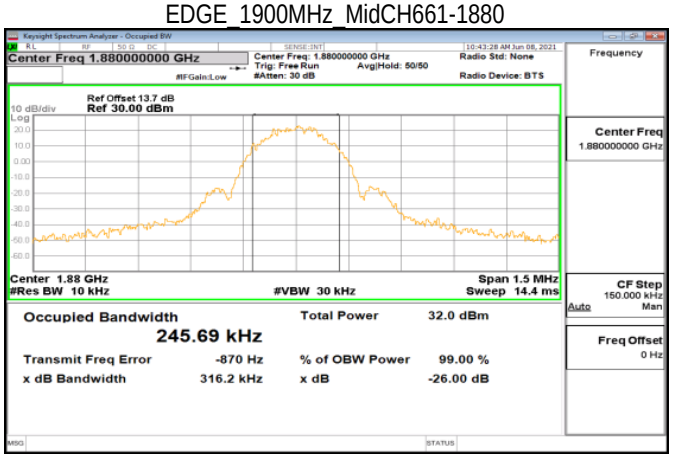

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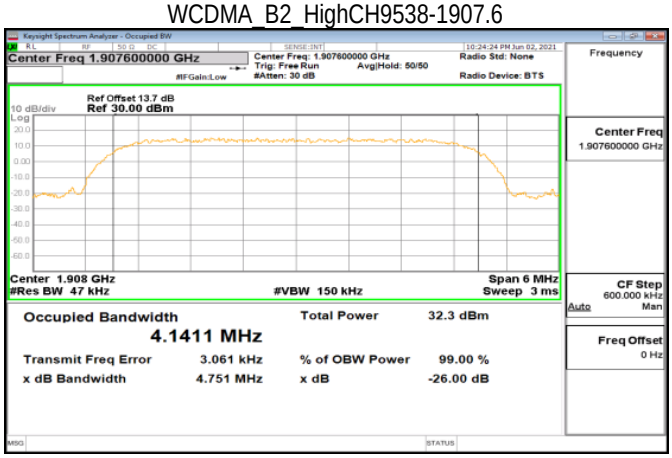
WCDMA_B2_HighCH9538-1907.6



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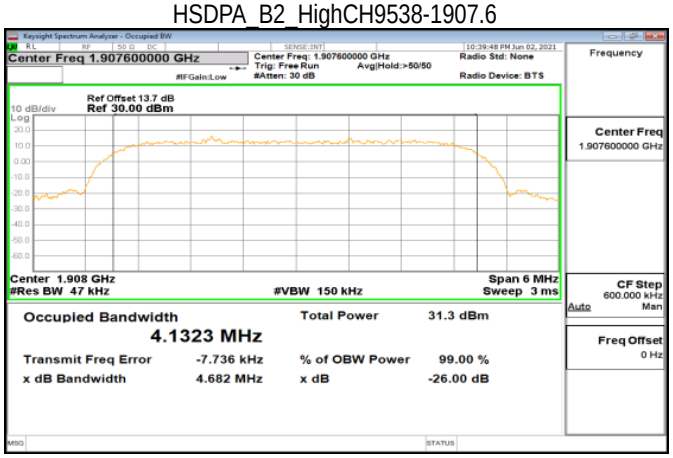

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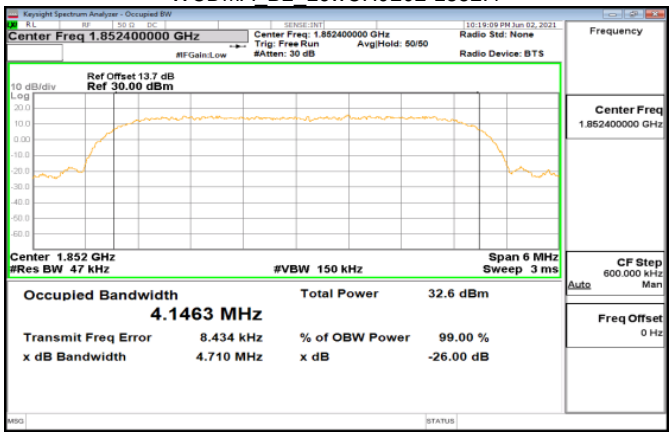

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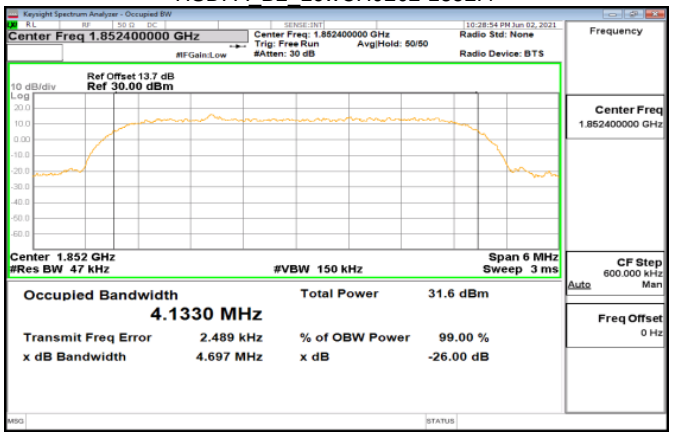

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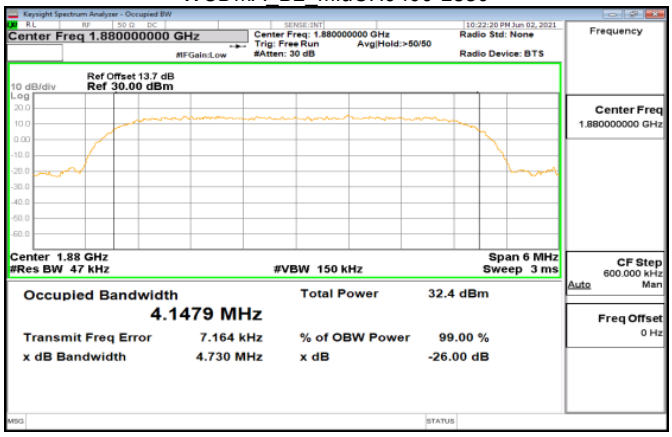

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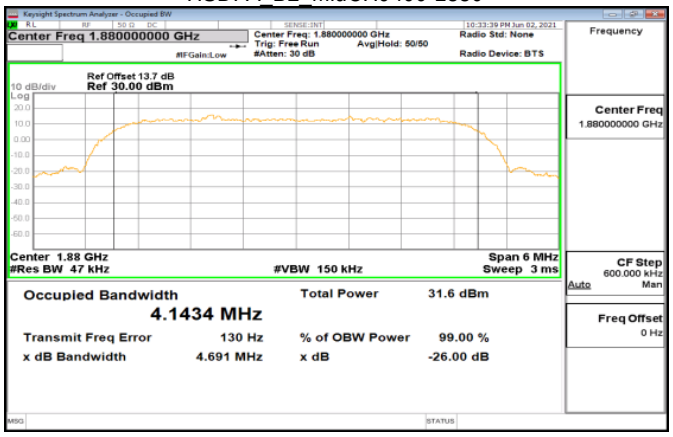

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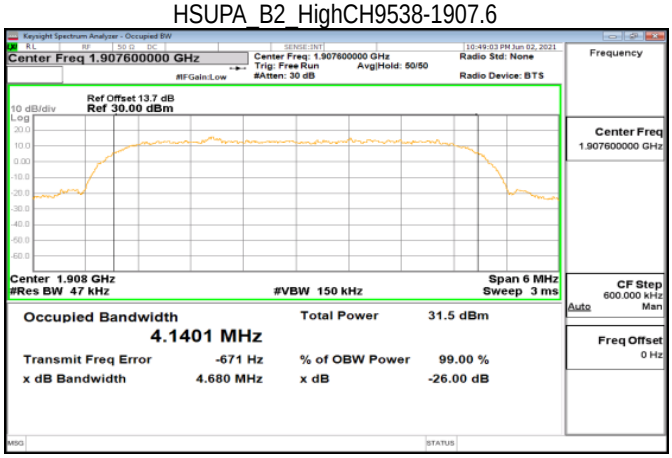

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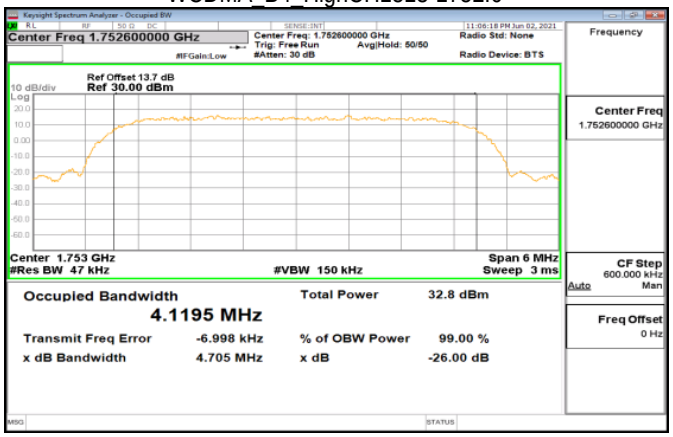

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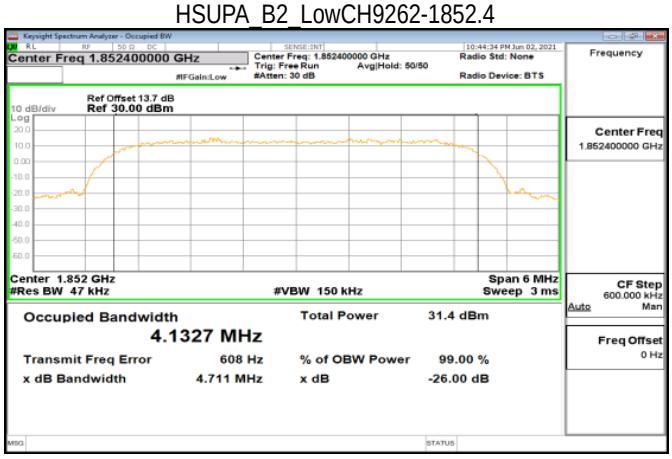

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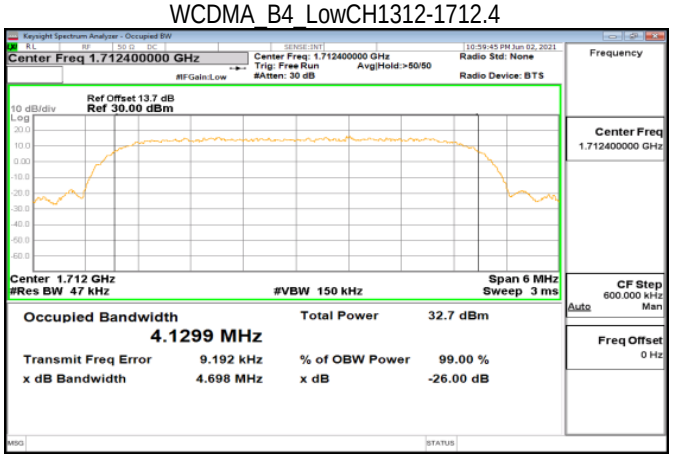

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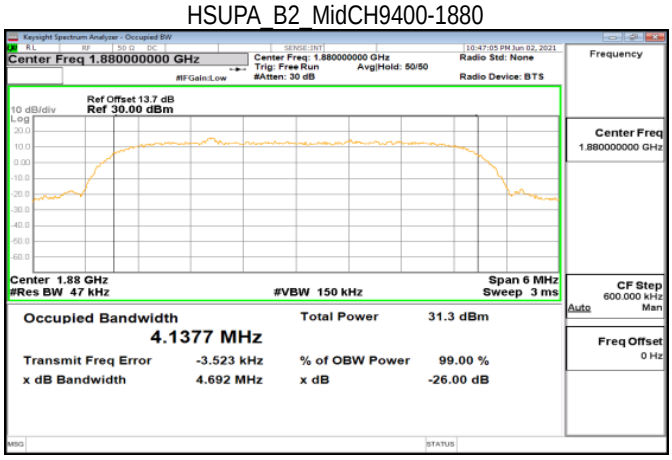

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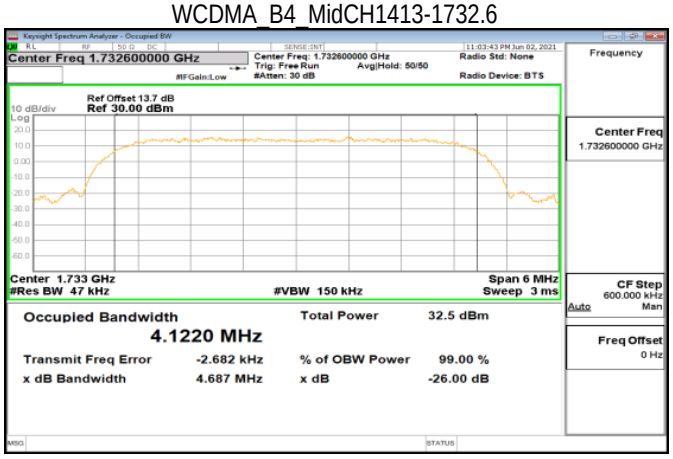

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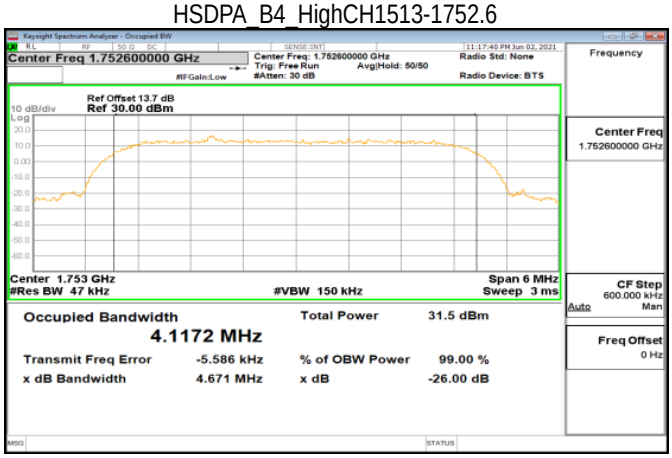

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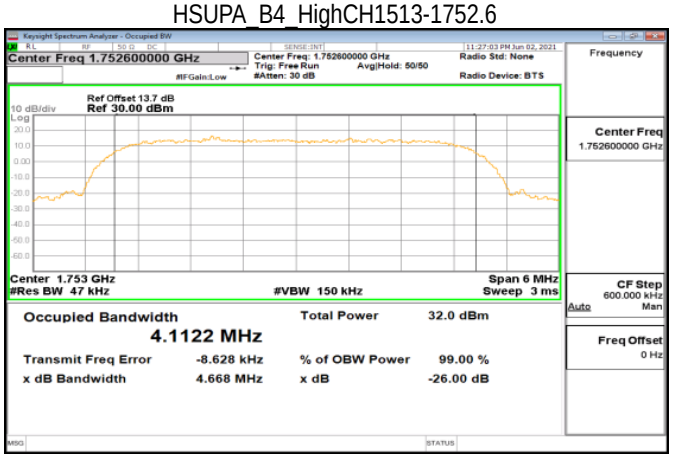

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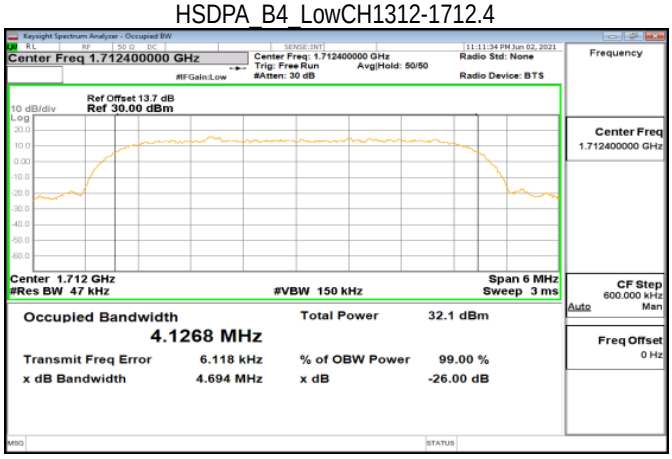

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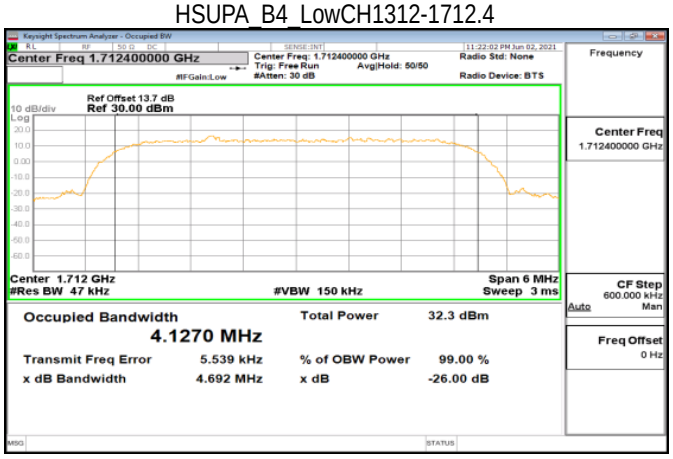

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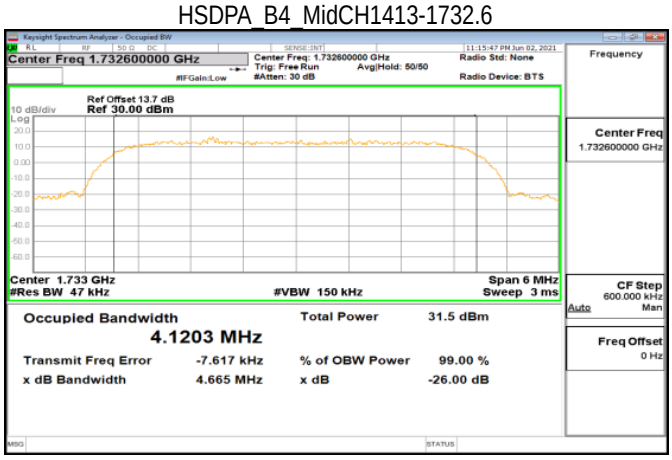

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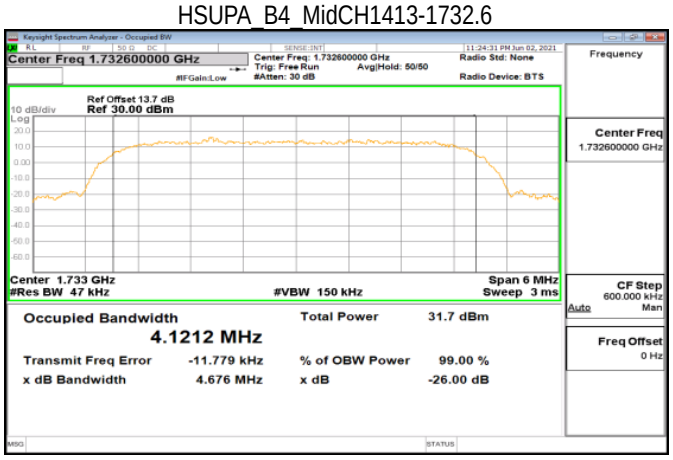

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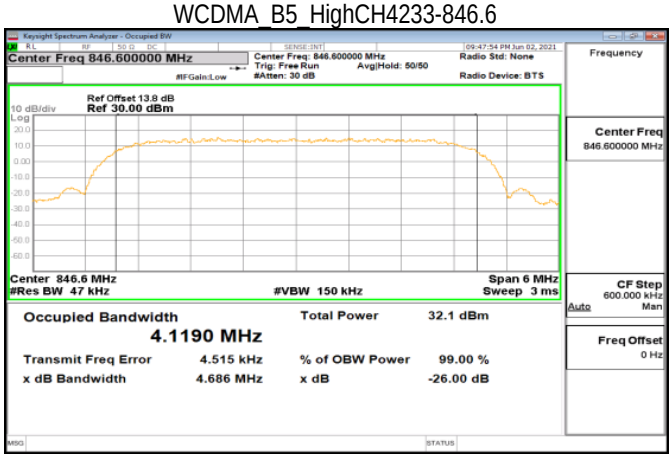
WCDMA_B5_HighCH4233-846.6



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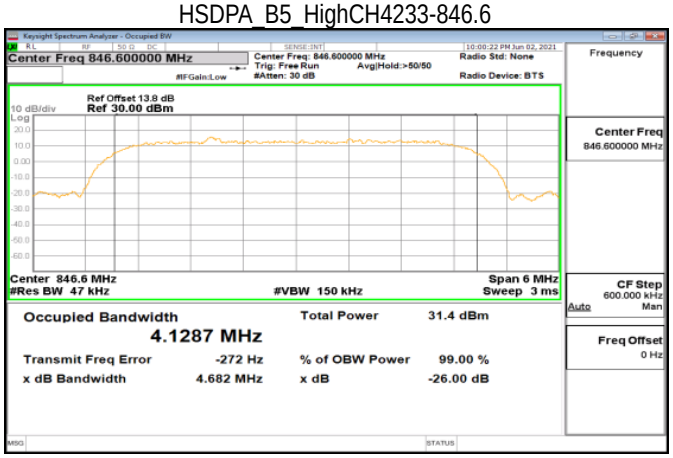

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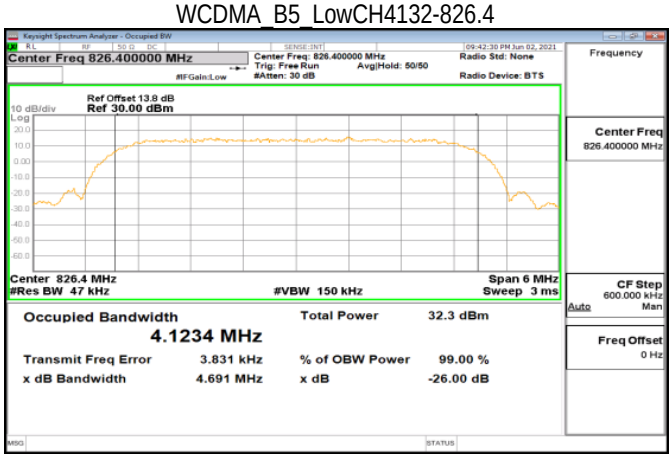

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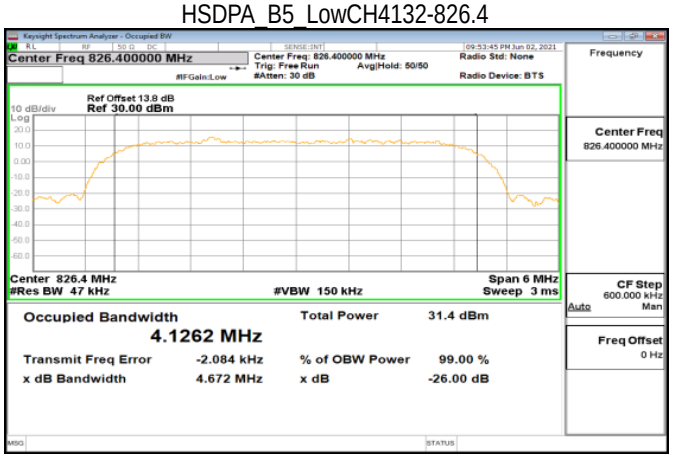

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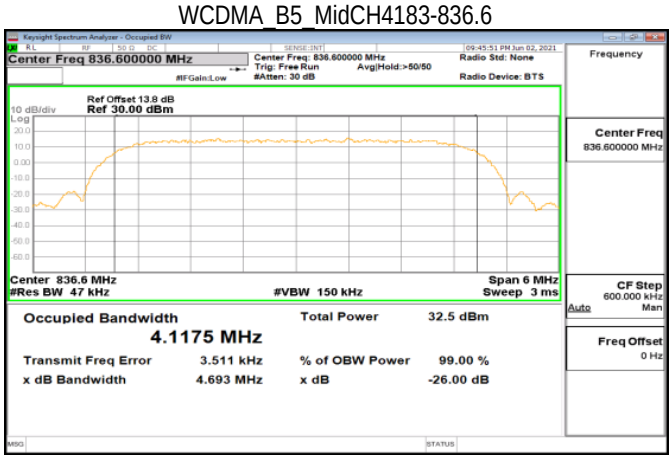

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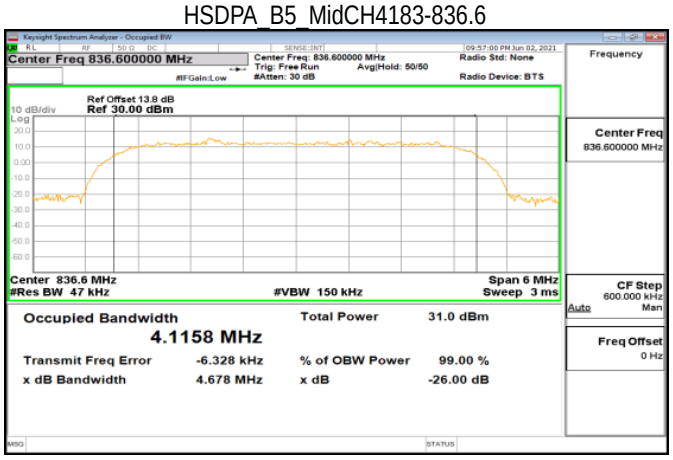

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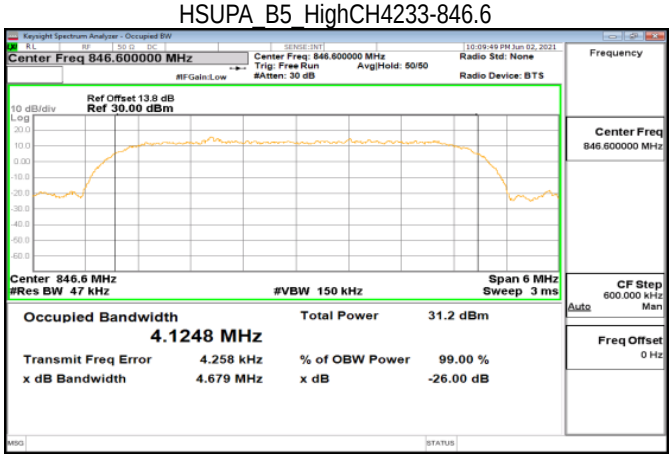

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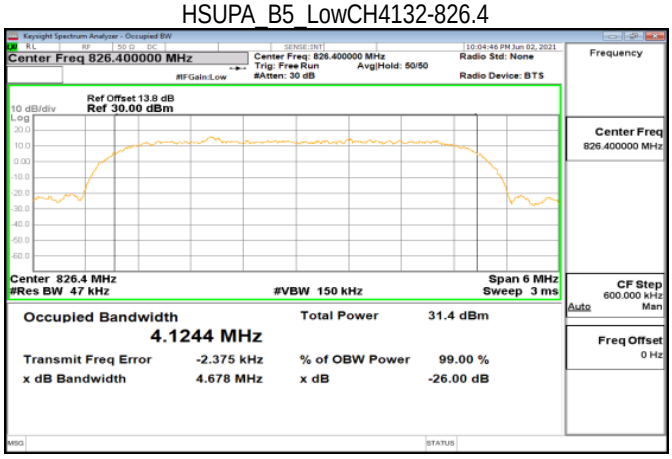

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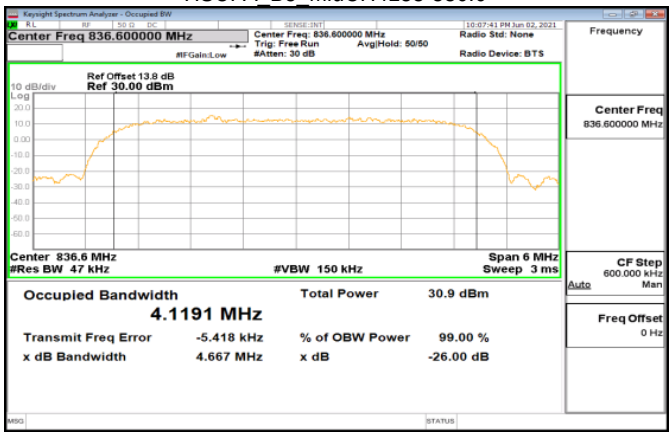

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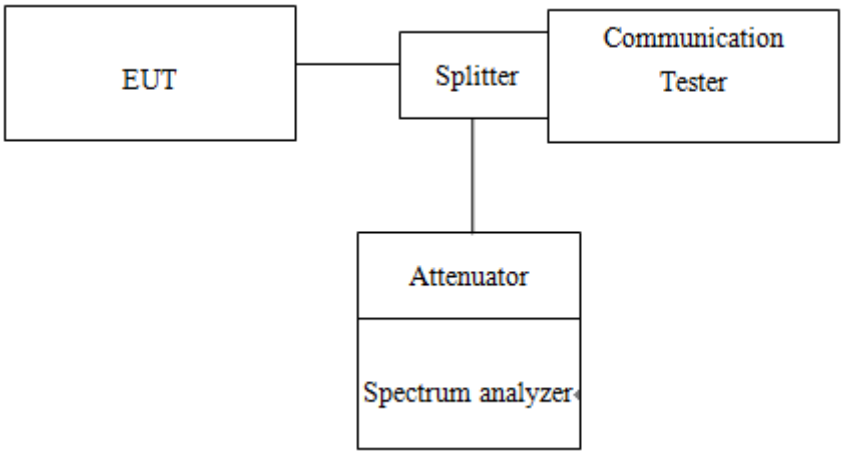
8 OUT OF BAND EMISSION AT ANTENNA TERMINALS

8.1 Standard Applicable

FCC §22.917(a), §24.238(a), §27.53(h)

Out of band emissions.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.

8.2 Test SET-UP



8.3 Measurement Procedure

8.3.1 Conducted Emission

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 1MHz & VBW = 1MHz on Spectrum.
3. Allow trace to fully stabilize
4. Repeat above procedures until all default test channel measured were complete.

8.3.2 Band Edge

1. To connect Antenna Port of EUT to Spectrum.
2. The band edge of low and high channels for the highest RF powers was measured. Setting RBW ≥ 1% EBW.
3. Allow trace to fully stabilize
4. Repeat above procedures until all default test channel measured were complete.

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8.4 Measurement Equipment Used

Conducted Emission Test Site: Conducted 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
Temperature Chamber	Giant Force	GTH-150-40-CP-AR	MAA0512-018	05/19/2021	05/18/2022
Radio Communication Analyer	Anritsu	MT8815B	6200711454	04/07/2021	04/06/2022
DC Power Supply	Agilent	E3640A	MY52410006	12/17/2020	12/16/2021
Attenuator	Mini-Circuit	BW-S10W2+	2	12/16/2020	12/15/2021
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021
Power Divider	RF-LAMBAD	RFLT2W1G 18G	11-JSPF412-018	12/16/2020	12/15/2021

8.5 Measurement Result:

Refer to next pages.

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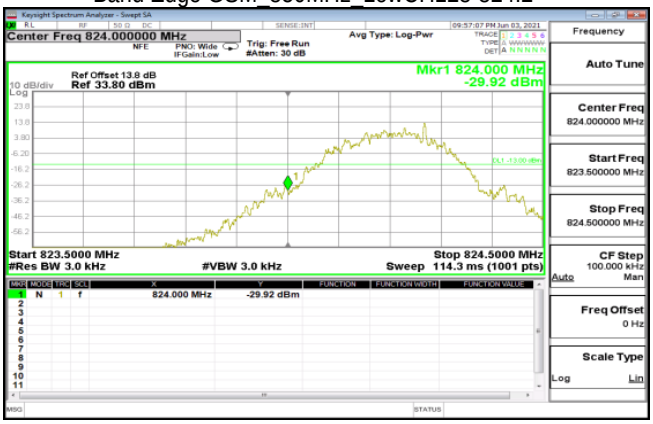
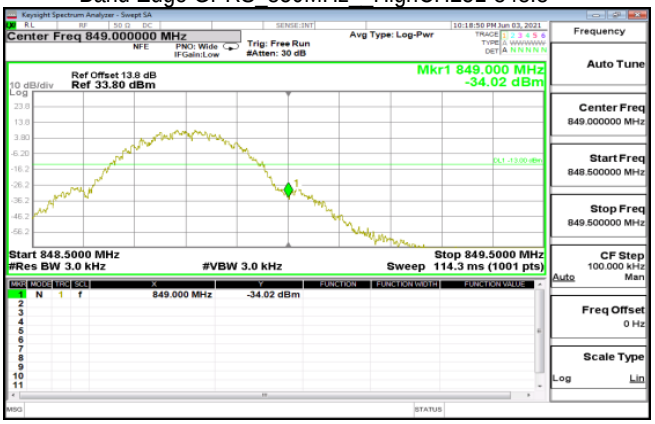
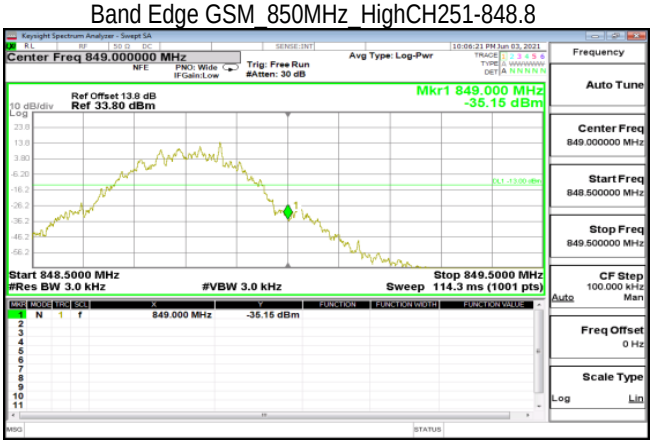
Band Edge GSM_850MHz_LowCH128-824.2



Band Edge GPRS_850MHz__HighCH251-848.8

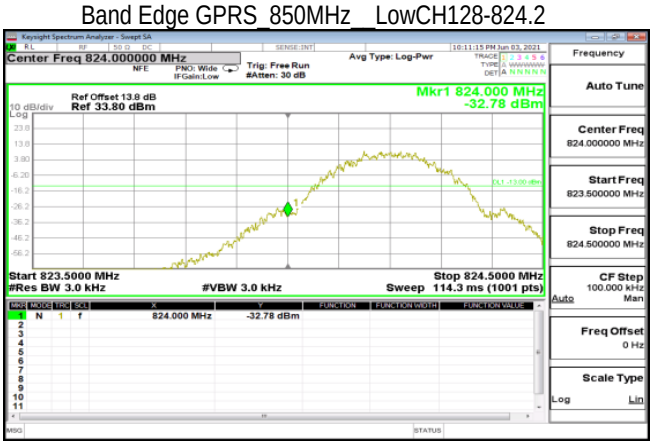


Band Edge GSM_850MHz_HighCH251-848.8



Band Edge EDGE_850MHz__LowCH128-824.2

Band Edge GPRS_850MHz__LowCH128-824.2



Band Edge EDGE_850MHz__HighCH251-848.8

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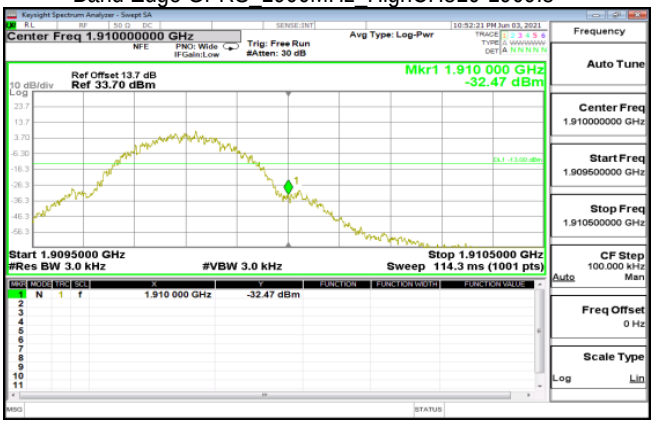
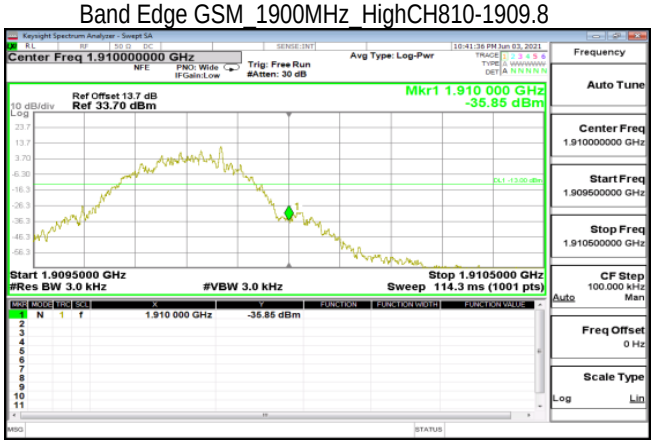
Band Edge GSM_1900MHz_LowCH512-1850.2

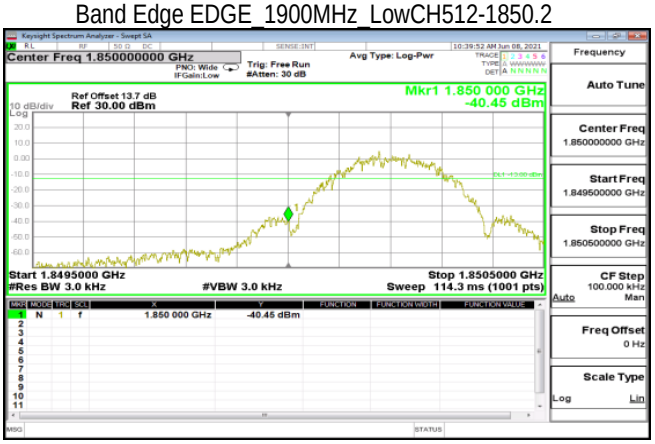
Band Edge GPRS_1900MHz_HighCH810-1909.8



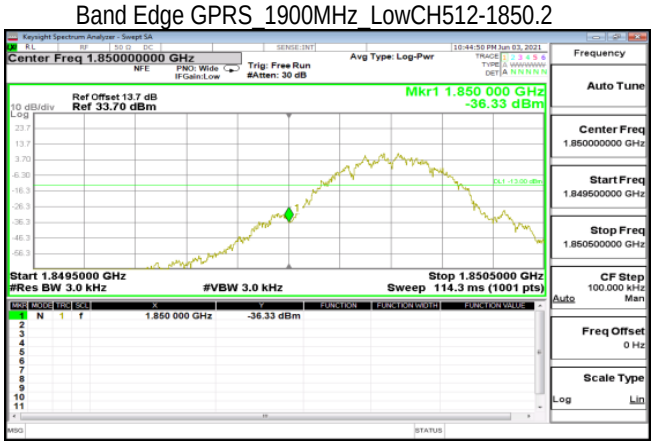
Band Edge GSM_1900MHz_HighCH810-1909.8



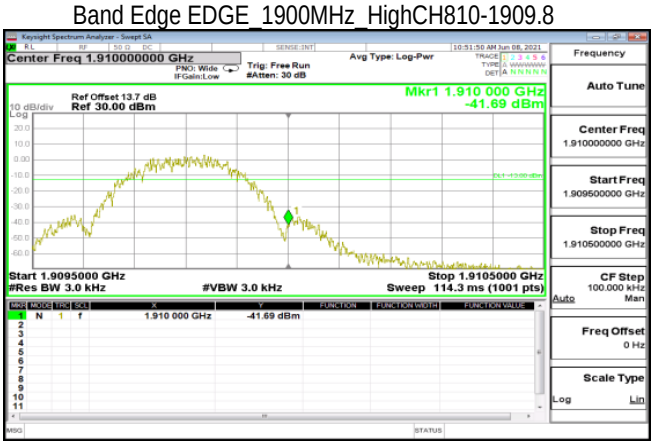
Band Edge EDGE_1900MHz_LowCH512-1850.2



Band Edge GPRS_1900MHz_LowCH512-1850.2



Band Edge EDGE_1900MHz_HighCH810-1909.8



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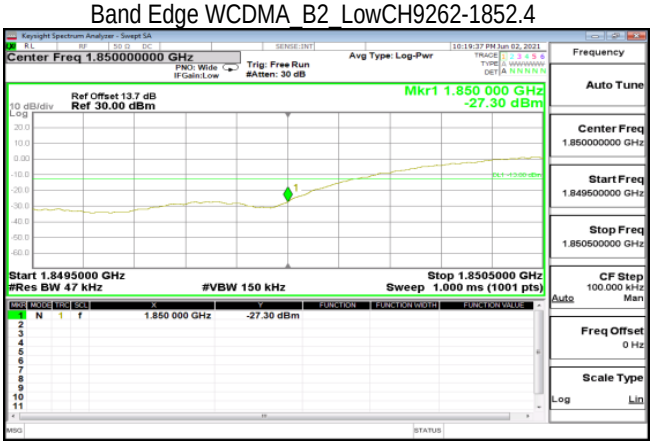
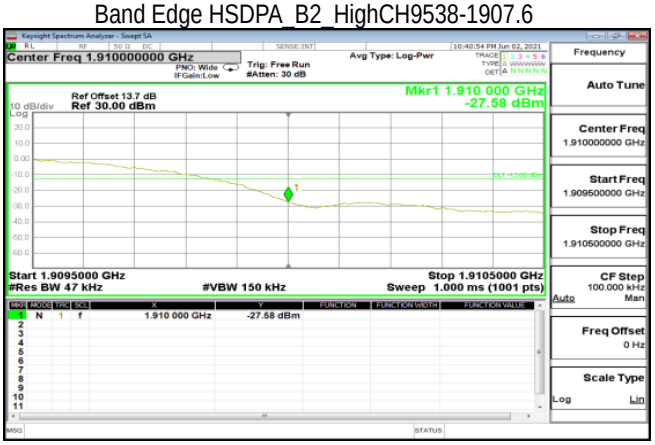
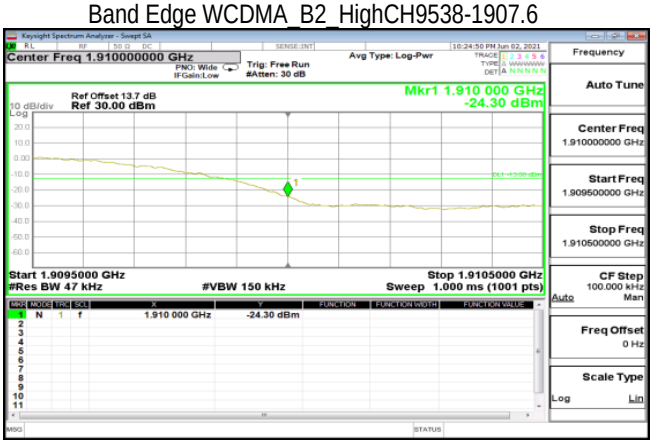
Band Edge WCDMA_B2_LowCH9262-1852.4



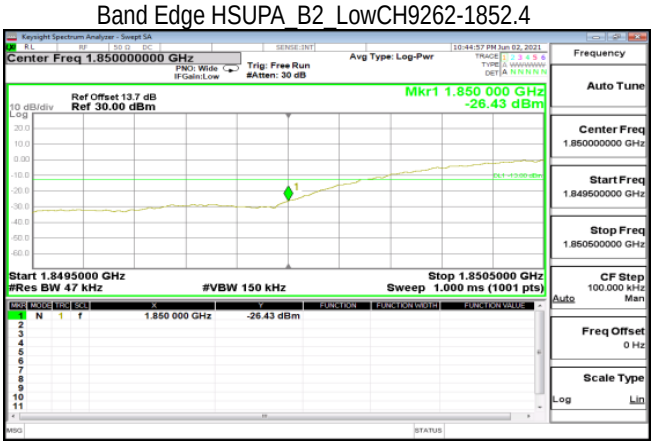
Band Edge HSDPA_B2_HighCH9538-1907.6



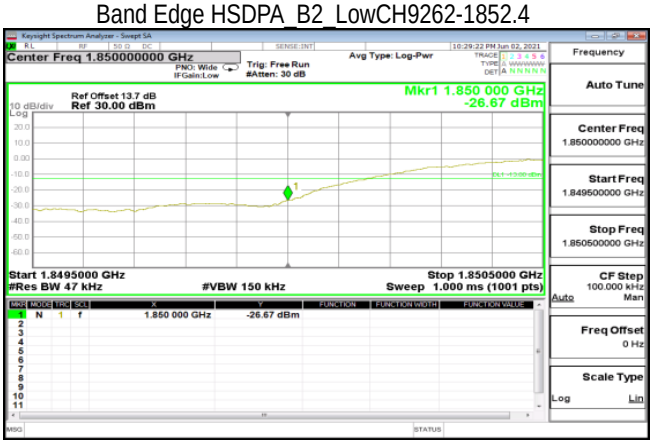
Band Edge WCDMA_B2_HighCH9538-1907.6



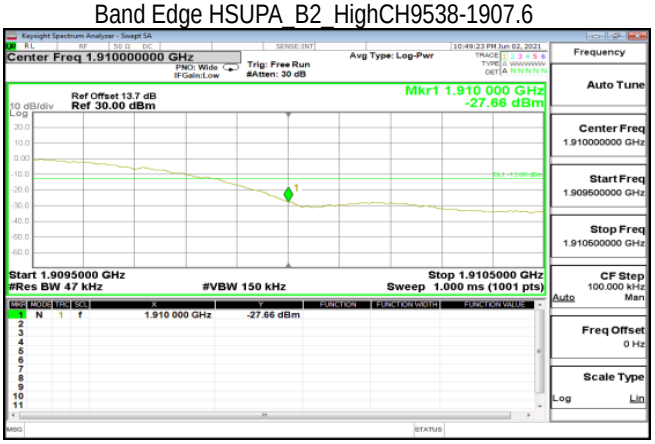
Band Edge HSUPA_B2_LowCH9262-1852.4



Band Edge HSDPA_B2_LowCH9262-1852.4



Band Edge HSUPA_B2_HighCH9538-1907.6



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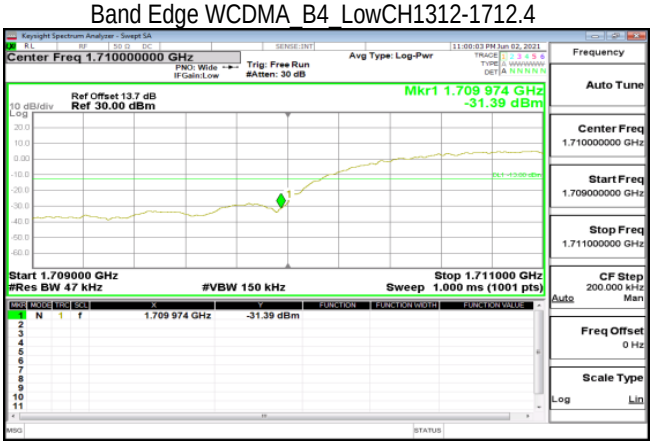
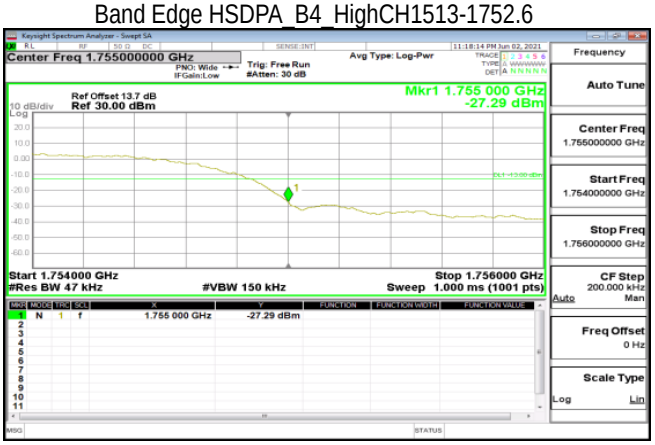
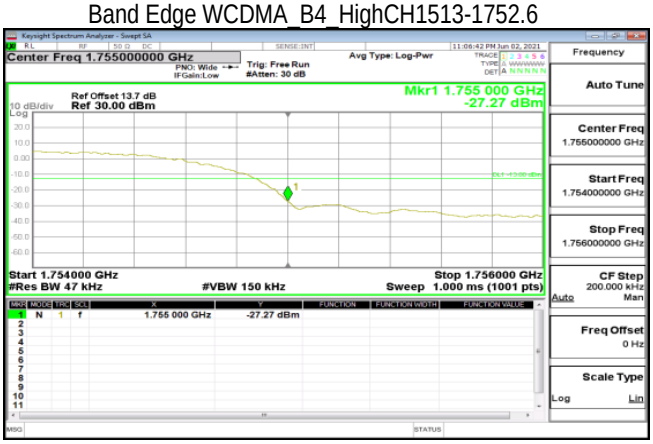
Band Edge WCDMA_B4_LowCH1312-1712.4



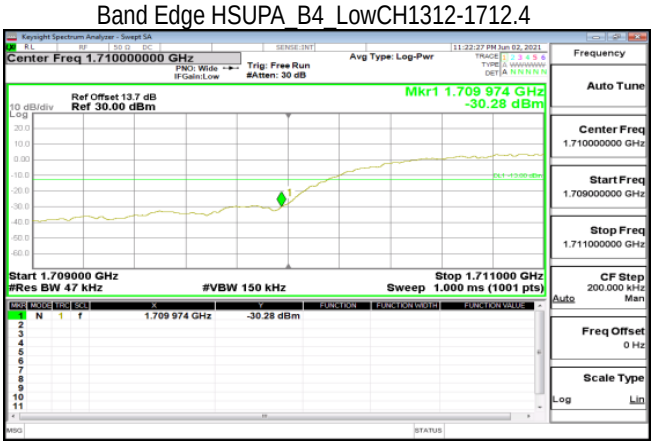
Band Edge HSDPA_B4_HighCH1513-1752.6



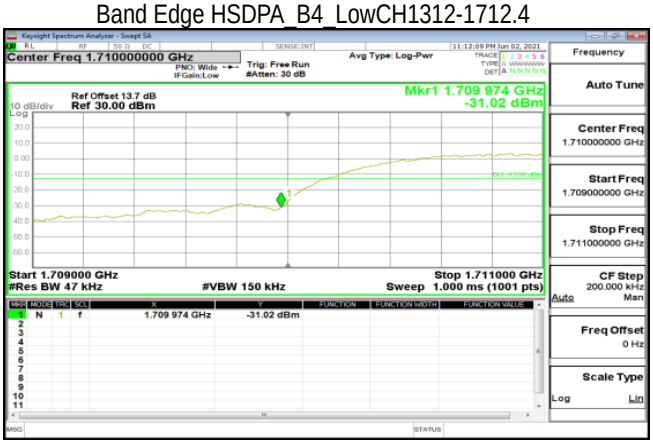
Band Edge WCDMA_B4_HighCH1513-1752.6



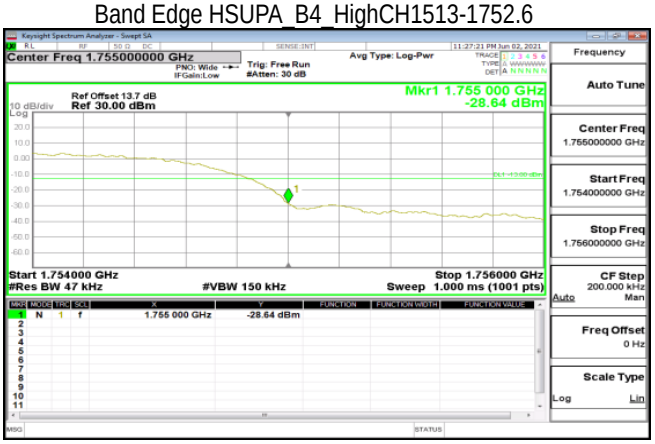
Band Edge HSUPA_B4_LowCH1312-1712.4



Band Edge HSDPA_B4_LowCH1312-1712.4



Band Edge HSUPA_B4_HighCH1513-1752.6



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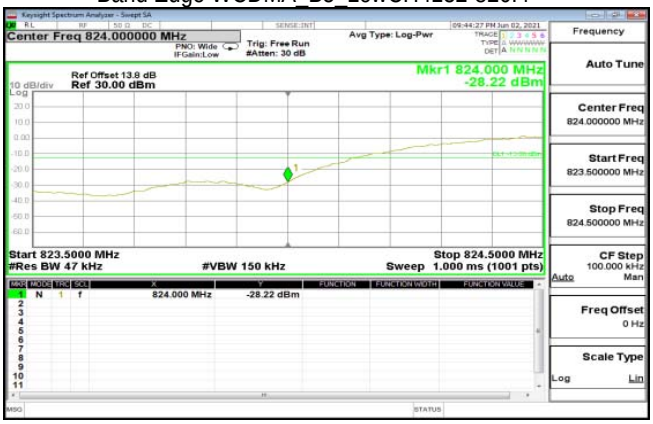
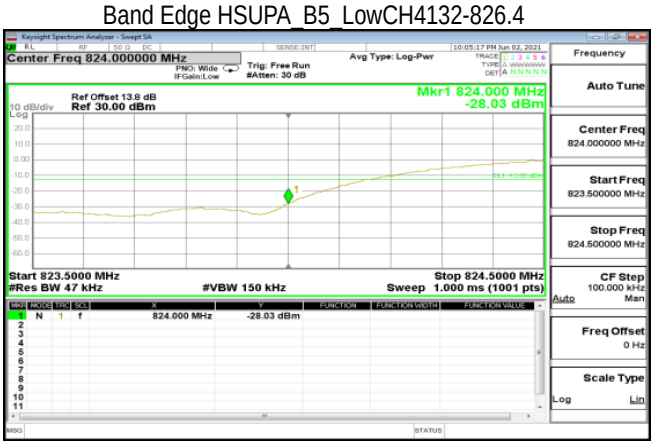
Band Edge WCDMA_B5_LowCH4132-826.4



Band Edge HSDPA_B5_HighCH4233-846.6

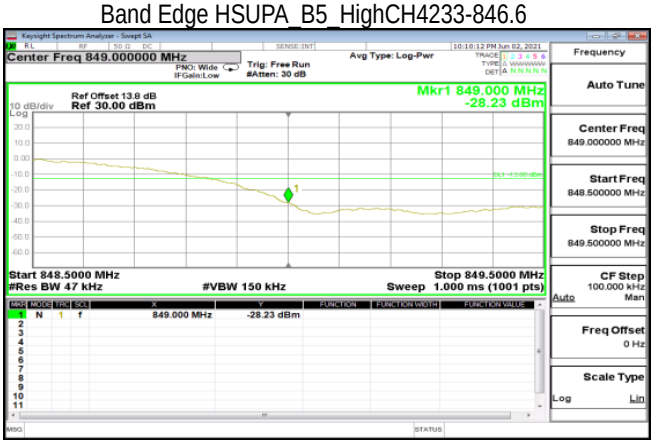
Band Edge WCDMA_B5_HighCH4233-846.6

Band Edge HSUPA_B5_LowCH4132-826.4



Band Edge HSDPA_B5_LowCH4132-826.4

Band Edge HSUPA_B5_HighCH4233-846.6



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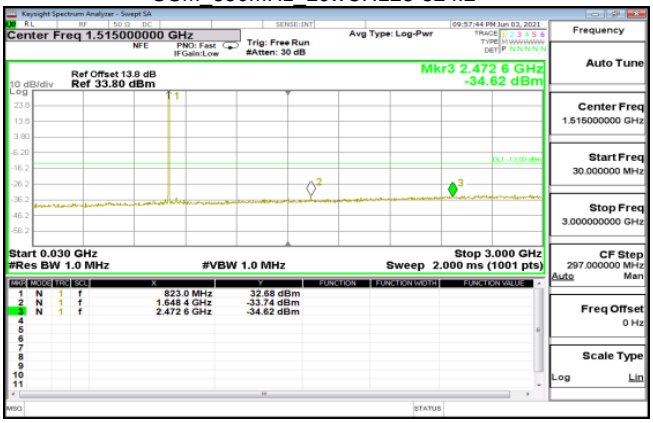
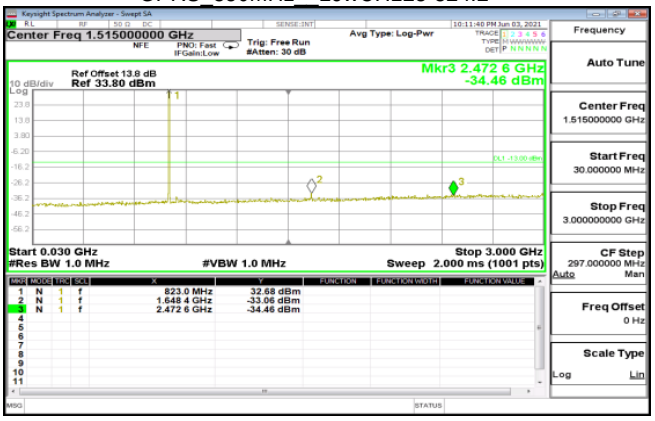
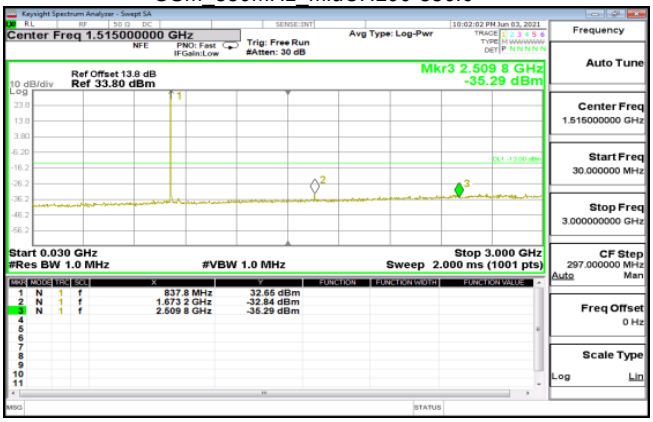
GSM_850MHz_LowCH128-824.2



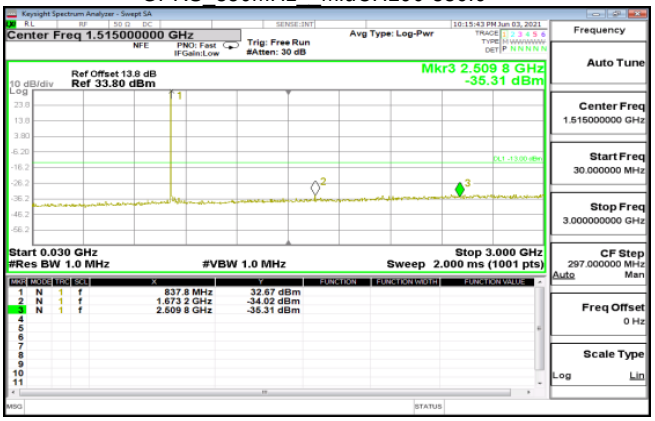
GPRS_850MHz__LowCH128-824.2



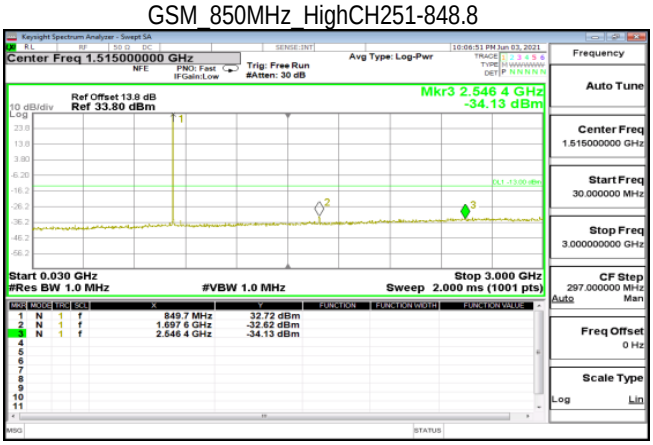
GSM_850MHz_MidCH190-836.6



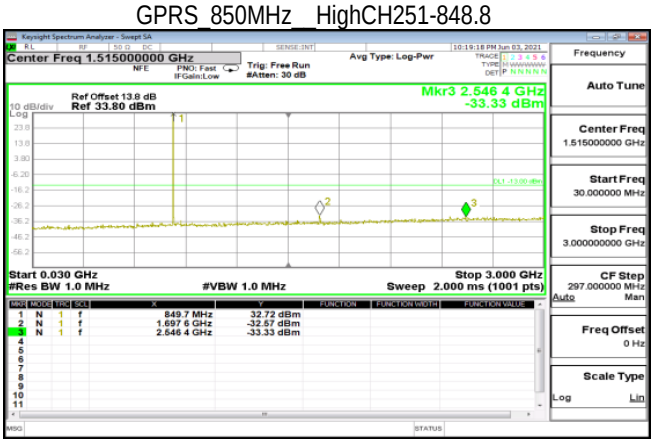
GPRS_850MHz__MidCH190-836.6



GSM_850MHz_HighCH251-848.8



GPRS_850MHz__HighCH251-848.8



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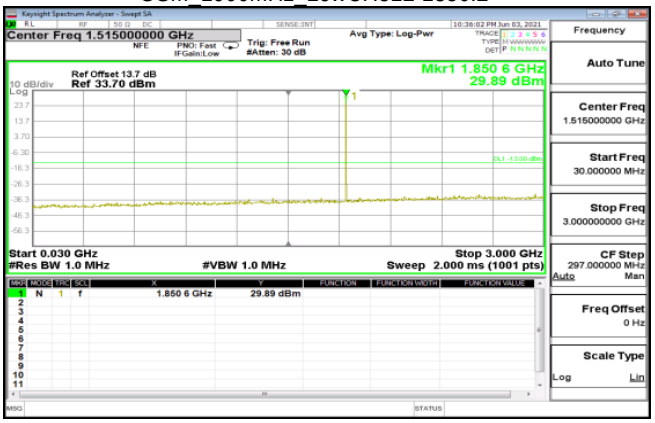
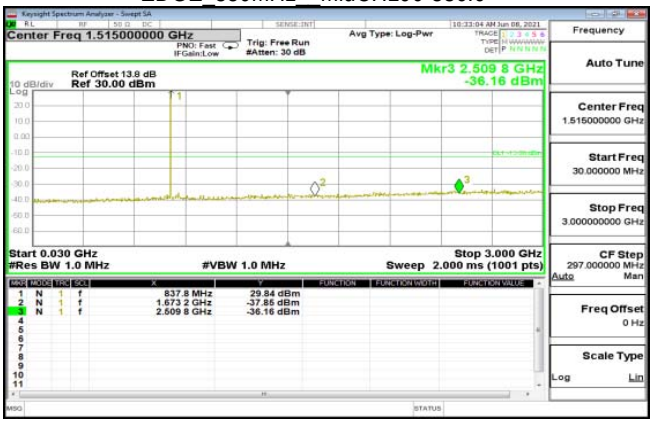
EDGE_850MHz__LowCH128-824.2

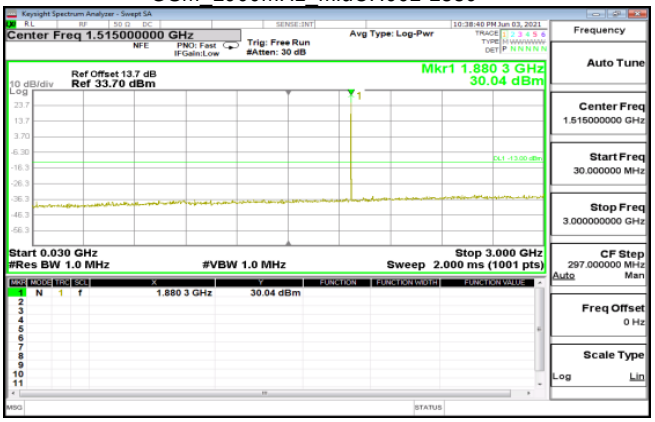
GSM_1900MHz_LowCH512-1850.2



EDGE_850MHz__MidCH190-836.6

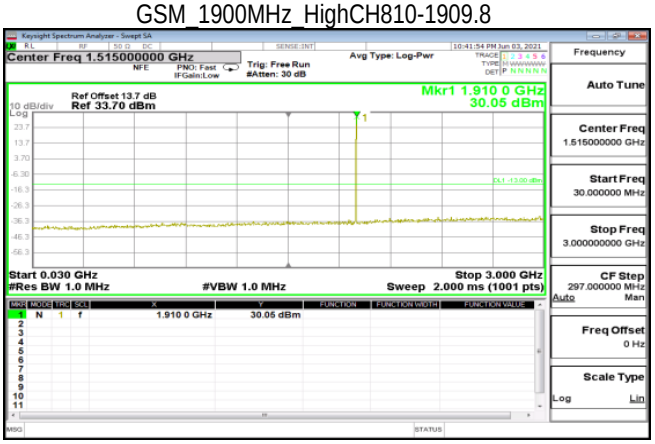


GSM_1900MHz_MidCH661-1880



EDGE_850MHz__HighCH251-848.8

GSM_1900MHz_HighCH810-1909.8



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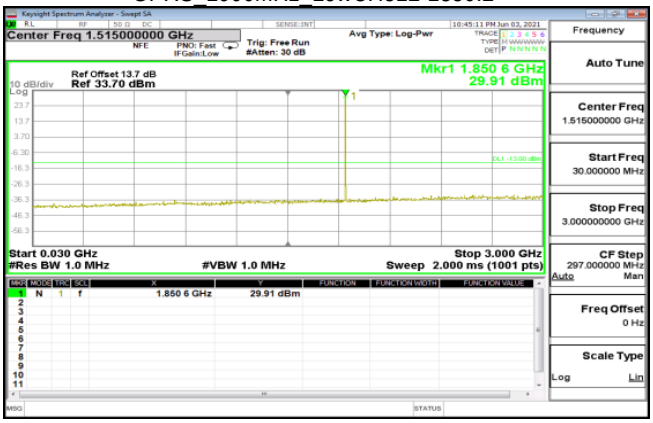
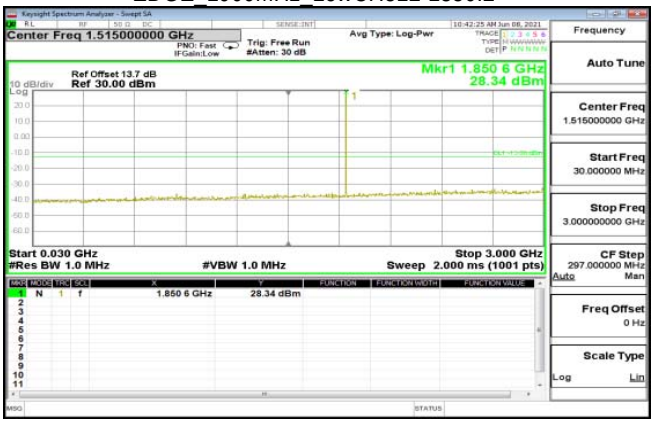
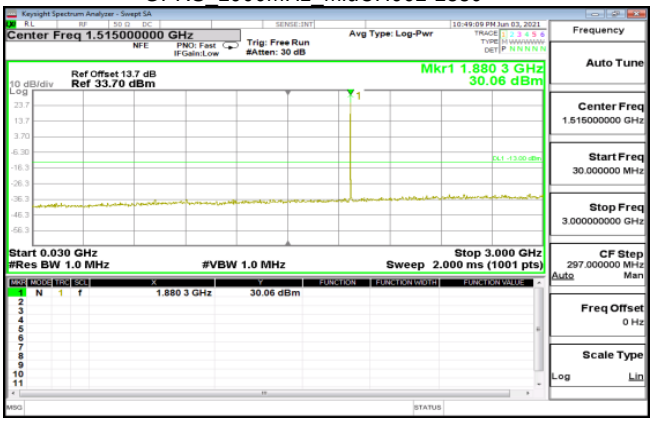
GPRS_1900MHz_LowCH512-1850.2



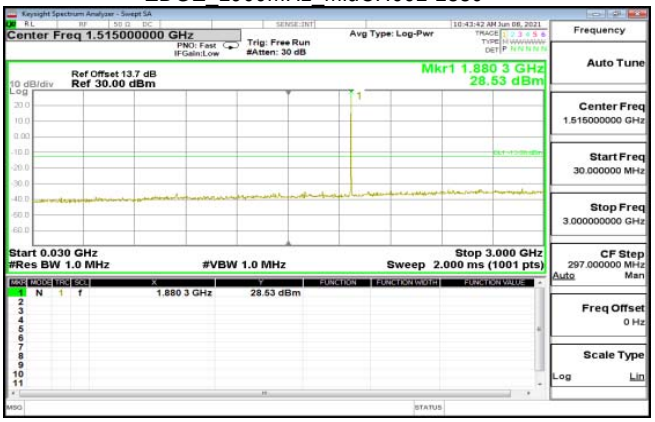
EDGE_1900MHz_LowCH512-1850.2



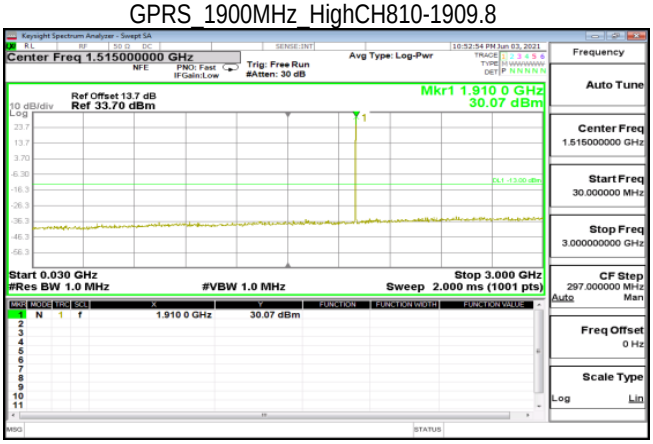
GPRS_1900MHz_MidCH661-1880



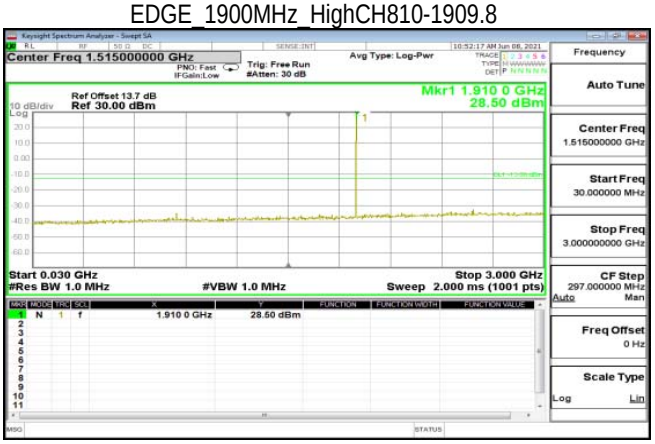
EDGE_1900MHz_MidCH661-1880



GPRS_1900MHz_HighCH810-1909.8



EDGE_1900MHz_HighCH810-1909.8



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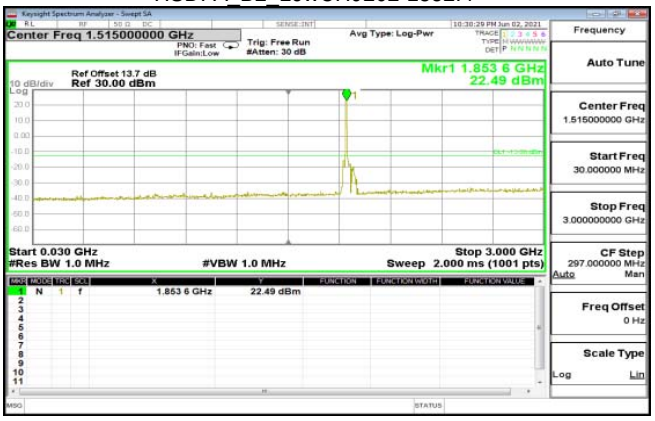
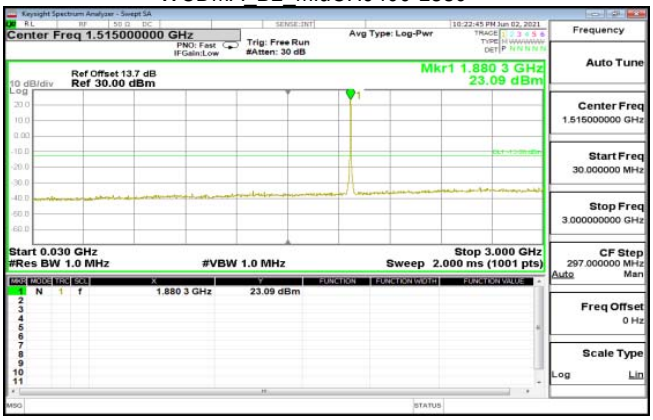
WCDMA_B2_LowCH9262-1852.4

HSDPA_B2_LowCH9262-1852.4

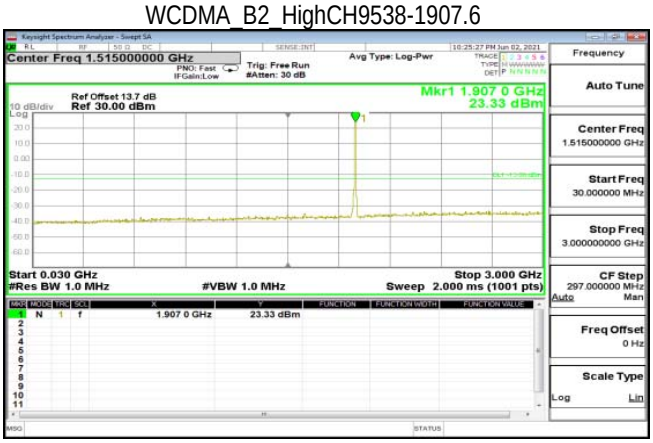


WCDMA_B2_MidCH9400-1880



HSDPA_B2_MidCH9400-1880

WCDMA_B2_HighCH9538-1907.6



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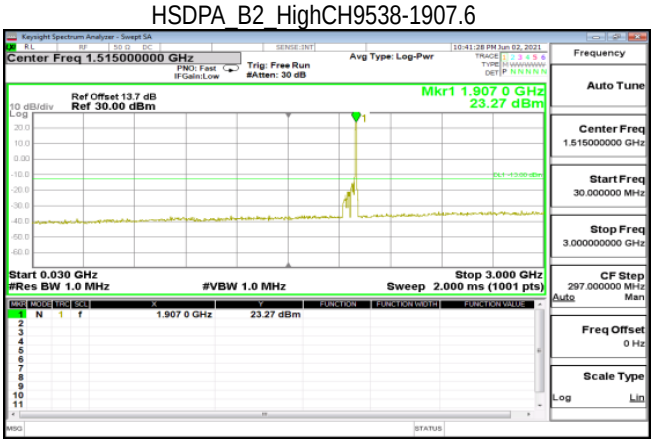

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