8.6 Radiated Spurious & Harmonic Emission (PCS)

FCC §2.1053, §24.238(a), RSS-133(6.5.1)

CH25 (1851.25 MHz)

Frequency (MHz)	Ant*. Pol.	Reading (dBm)	Level at Antenna Terminal (dBm)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
3701.88	V	-50.8	-46.4	10.02	-36.4	-13	23.4
5552.50	V	-58.2	-48.9	10.46	-38.4	-13	25.4
7406.88	V	-64.5	-46.9	9.20	-37.7	-13	24.7
9255.00	V	-55.7	-36.4	10.23	-26.2	-13	13.2

Radiated Measurements at 3meters

CH 600 (1880.00 MHz)

Frequency (MHz)	Ant*. Pol.	Reading (dBm)	Level at Antenna Terminal (dBm)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
3759.38	V	-55.7	-50.9	10.09	-40.8	-13	27.8
5640.00	V	-62.3	-53.3	10.54	-42.8	-13	29.8
7520.63	V	-66.1	-48.6	9.11	-39.5	-13	26.5
9400.00	V	-60.9	-41.7	10.08	-31.6	-13	18.6

Radiated Measurements at 3meters

CH 1175 (1908.75 MHz)

Frequency (MHz)	Ant*. Pol.	Reading (dBm)	Level at Antenna Terminal (dBm)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
3816.88	V	-55.3	-50.3	10.15	-40.1	-13	27.1
5726.25	V	-57.0	-47.3	10.62	-36.7	-13	23.7
7634.38	V	-65.6	-48.9	9.03	-39.9	-13	26.9
9545.00	V	-63.8	-44.7	9.93	-34.8	-13	21.8

Radiated Measurements at 3meters

Note: Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2..4, Aug. 17, 2004.

This device was tested under all R.C.s and S.O.s. The worst case is reported with FTAP Rate 2Slot 307.2 kbps/RETAP Rate 9.6 kbps with 'All Up' power control bits.

ERP(dB) =Level at Antenna Terminal(dBm) + Antenna Gain(dBd)

1. **Ant Pol. H =Horizontal V=Vertical*
2. *For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz with peak measurements*
3. *The spectrum is measured to 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.*

8.7 Frequency Stability / Temperature Variation (Cellular)

Test channel : Middle channel (836.52 MHz)

Standard test voltage : 3.8 Vdc

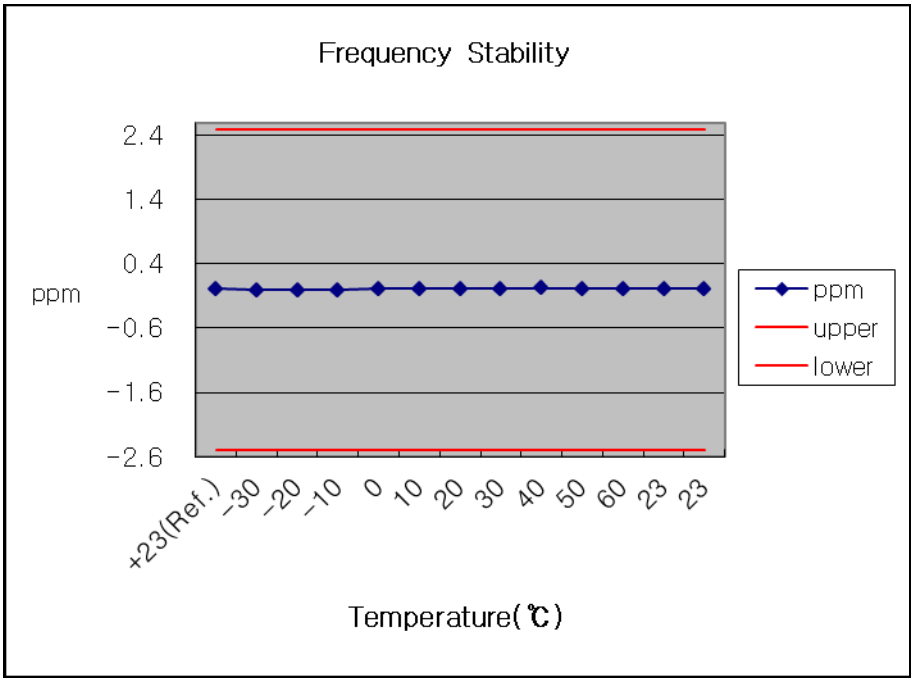
Deviation Limit : ±2.5 ppm

Measurement Result :

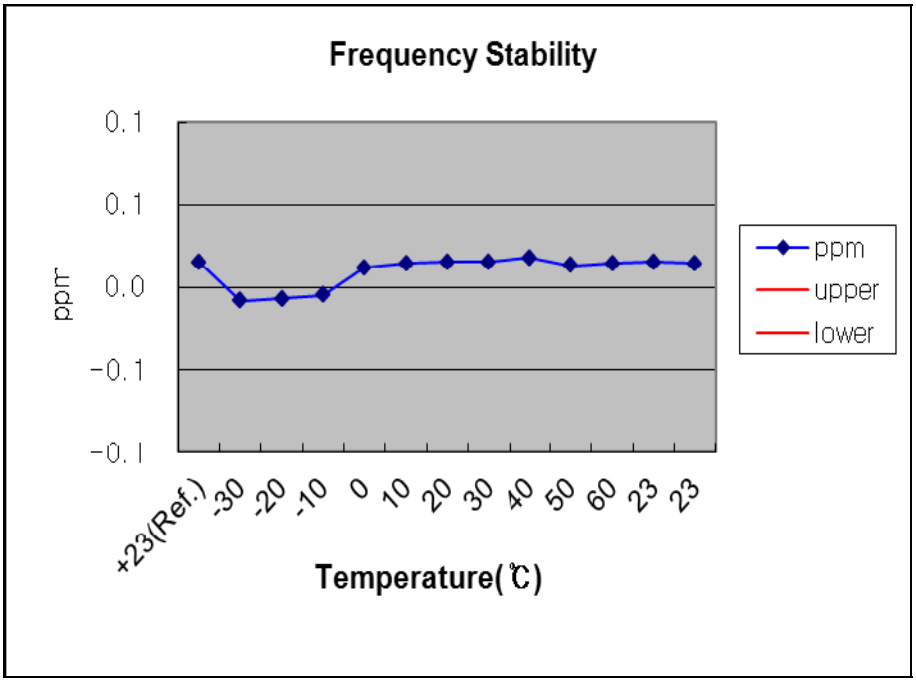
Voltage (%)	Power (Vdc)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	ppm
100%	3.8	+23(Ref.)	836,520,013	13	0.0155
100%		-30	836,519,993	-7	-0.0084
100%		-20	836,519,994	-6	-0.0072
100%		-10	836,519,996	-4	-0.0048
100%		0	836,520,010	10	0.0120
100%		10	836,520,012	12	0.0143
100%		20	836,520,013	13	0.0155
100%		30	836,520,013	13	0.0155
100%		40	836,520,015	15	0.0179
100%		50	836,520,011	11	0.0131
100%		60	836,520,012	12	0.0143
85%	3.23	23	836,520,013	13	0.0155
115%	4.37	23	836,520,012	12	0.0143

***The temperature is varied from -30°C to +60°C using an environmental chamber.**

Frequency Stability Graph (PCS)



Zoom In



8.8 Frequency Stability / Temperature Variation (PCS)

Test channel : Middle channel (1880.00 MHz)

Standard test voltage : 3.8 Vdc

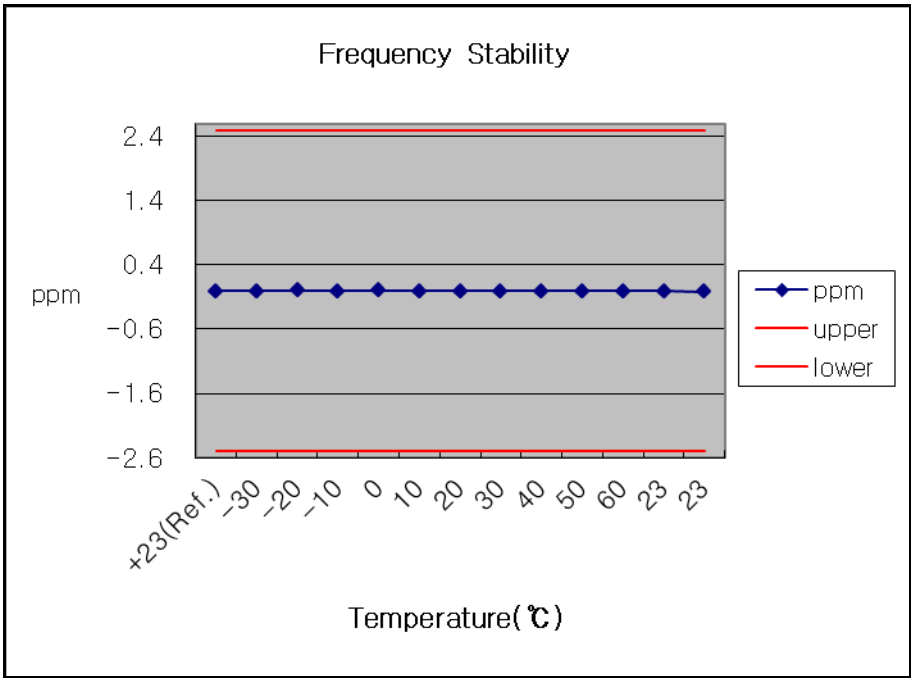
Deviation Limit : ±2.5 ppm

Measurement Result :

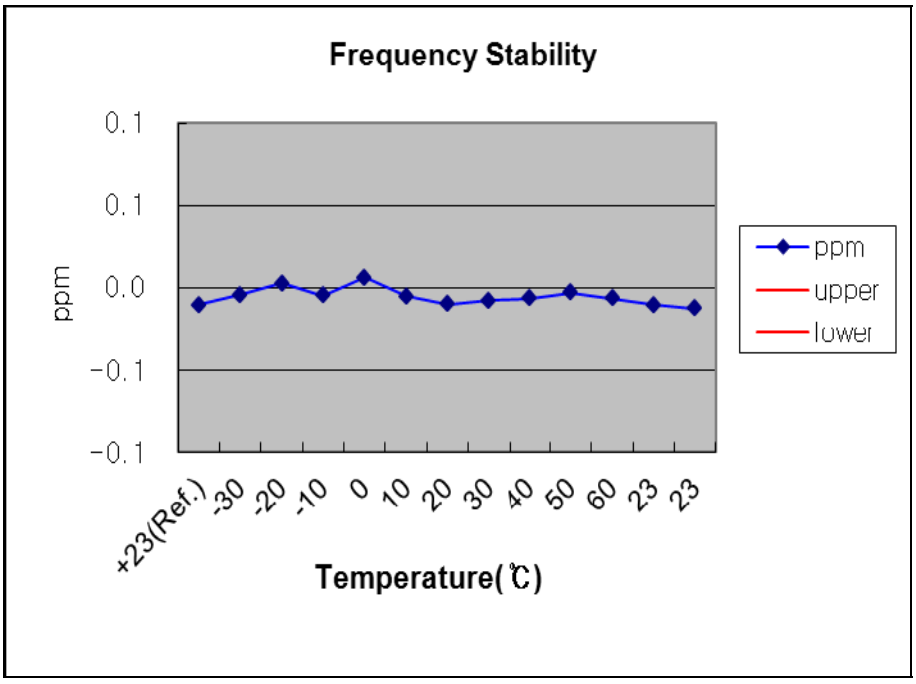
Voltage (%)	Power (Vdc)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	ppm
100%	3.8	+23(Ref.)	1,879,999,980	-20	-0.0106
100%		-30	1,879,999,992	-8	-0.0043
100%		-20	1,880,000,005	5	0.0027
100%		-10	1,879,999,991	-9	-0.0048
100%		0	1,880,000,011	11	0.0059
100%		10	1,879,999,990	-10	-0.0053
100%		20	1,879,999,981	-19	-0.0101
100%		30	1,879,999,985	-15	-0.0080
100%		40	1,879,999,988	-12	-0.0064
100%		50	1,879,999,994	-6	-0.0032
100%		60	1,879,999,988	-12	-0.0064
85%	3.23	23	1,879,999,980	-20	-0.0106
115%	4.37	23	1,879,999,976	-24	-0.0128

***The temperature is varied from -30°C to +60°C using an environmental chamber.**

Frequency Stability Graph (PCS)



Zoom In

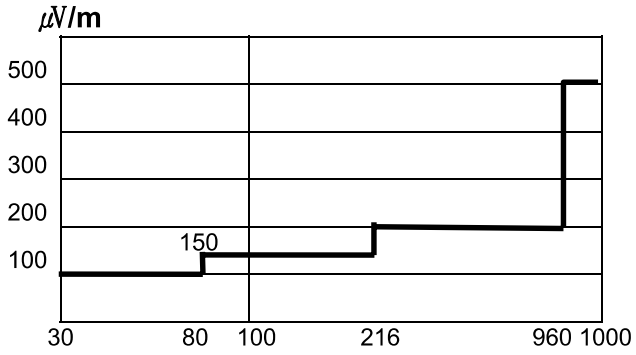


8.9 Receiver Spurious Emissions

RSS-Gen(6.1), RSS-132(4.6), RSS-133(6.6)

Frequency (MHz)	Pol* (H/V)	Reading (dBμV/m)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
43.10	V	43.0	-17.3	25.7	40.0	14.3
157.07	V	38.3	-10.2	28.1	43.5	15.4
681.84	H	39.1	-5.3	33.8	46.0	12.2
706.09	H	39.0	-5.3	33.7	46.0	12.3
748.29	V	39.1	-4.5	34.6	46.0	11.4
881.66	V	40.5	-2.4	38.1	46.0	7.9

Radiated Measurements at 3 meters



Notes:
1. All modes were measured and the worst-case emission was reported.
2 The radiated limits are shown on Figure 5. Above 1 GHz the limit is 500 μV/m.

Fig. 5. Limits at 3 meters

Notes:
*1. *Pol. H = Horizontal, V = Vertical*
*2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.*
3. Measurements using CISPR quasi-peak mode.
4. The limit is on the IC RSS GEN Clause 6.1.

9. ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

1. Conducted Uncertainty Calculation

Source of Uncertainty	*Xi*	Uncertainty of *Xi*		Coverage factor *k*	*u(Xi)* (dB)	*Ci*	*Ci u(Xi)* (dB)
		Value (dB)	Probability Distribution				
Receiver reading	***RI***	± 0.1	normal 1	1.000	0.1	1	0.1
Attenuation AMN-Receiver	***LC***	± 0.08	normal 2	2.000	0.04	1	0.04
AMN Voltage division factor	***LAMN***	± 0.8	normal 2	2.000	0.4	1	0.4
Sine wave voltage	***dVSW***	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	***dVPA***	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	***dVPR***	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	***dVNF***	± 0.00	-	-	0.00	1	0.00
AMN Impedance	***dZ***	± 1.80	triangular	2.449	0.73	1	0.73
ⓐ Mismatch	***M***	+ 0.70	U-Shaped	1.414	0.49	1	0.49
ⓑ Mismatch	***M***	- 0.80	U-Shaped	1.414	- 0.56	1	- 0.56
Measurement System Repeatability	***RS***	0.05	normal 1	1.000	0.05	1	0.05
Remark	ⓐ: AMN-Receiver Mismatch : + ⓑ: AMN-Receiver Mismatch : -						
Combined Standard Uncertainty	Normal			± 1.88			
Expended Uncertainty U	Normal (k = 2)			± 3.76			

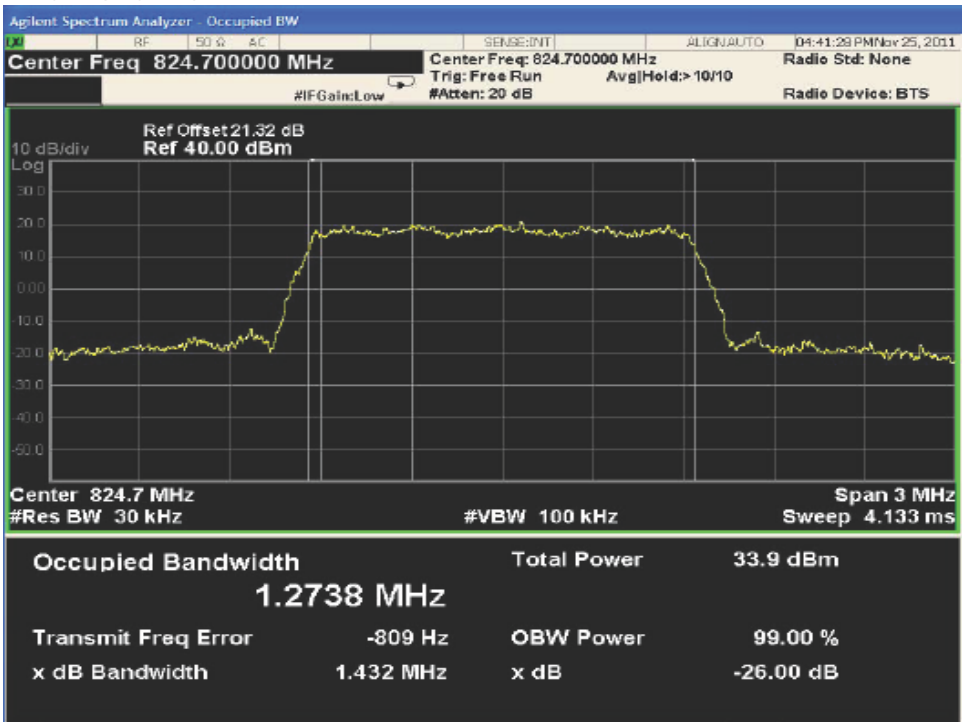
2. Radiation Uncertainty Calculation

Source of Uncertainty	*Xi*	Uncertainty of *Xi*		Coverage factor *k*	*u(Xi)* (dB)	*Ci*	*Ci u(Xi)* (dB)
		Value (dB)	Probability Distribution				
Receiver reading	***RI***	± 0.10	normal 1	1.000	0.10	1	0.10
Sine wave voltage	***dVsw***	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	***dVpa***	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	***dVpr***	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	***dVnf***	± 0.50	normal 2	2.000	0.25	1	0.25
Antenna Factor Calibration	***AF***	± 1.50	normal 2	2.000	0.75	1	0.75
Attenuation Antenna-receiver	***CL***	± 0.52	normal 2	2.000	0.26	1	0.26
Antenna Directivity	***AD***	± 1.00	rectangular	1.732	0.58	1	0.58
Antenna Factor Height Dependence	***AH***	± 0.50	rectangular	1.732	0.29	1	0.29
Antenna Phase Centre Variation	***AP***	± 0.30	rectangular	1.732	0.17	1	0.17
Antenna Factor Frequency Interpolation	***AI***	± 0.30	rectangular	1.732	0.17	1	0.17
Site Imperfections	***SI***	± 4.00	triangular	2.449	1.63	1	1.63
Measurement Distance Variation	***DV***	± 0.10	rectangular	1.732	0.06	1	0.06
Antenna Balance	***Dbal***	± 0.90	rectangular	1.732	0.52	1	0.52
Cross Polarisation	***DCross***	± 0.90	rectangular	1.732	0.52	1	0.52
ⓐ Mismatch	***M***	+ 0.25	U-Shaped	1.414	0.18	1	0.18
ⓑ Mismatch	***M***	- 0.26	U-Shaped	1.414	- 0.18	1	- 0.18
ⓒ Mismatch	***M***	+ 0.98	U-Shaped	1.414	0.69	1	0.69
ⓓ Mismatch	***M***	- 1.11	U-Shaped	1.414	- 0.79	1	- 0.79
Measurement System Repeatability	***RS***	0.09	normal 1	1.000	0.09	1	0.09
Remark	ⓐ: Biconical Antenna-receiver Mismatch : + (< 200 MHz) ⓑ: Biconical Antenna-receiver Mismatch : - (< 200 MHz) ⓒ: Log Periodic Antenna-receiver Mismatch : + (≧ 200 MHz) ⓓ: Log Periodic Antenna-receiver Mismatch : - (≧ 200 MHz)						
Combined Standard Uncertainty	Normal			± 2.63 (< 200 MHz) ± 2.74 (≧200 MHz)			
Expended Uncertainty U	Normal (*k* = 2)			± 5.26 (< 200 MHz) ± 5.48 (≧200 MHz)			

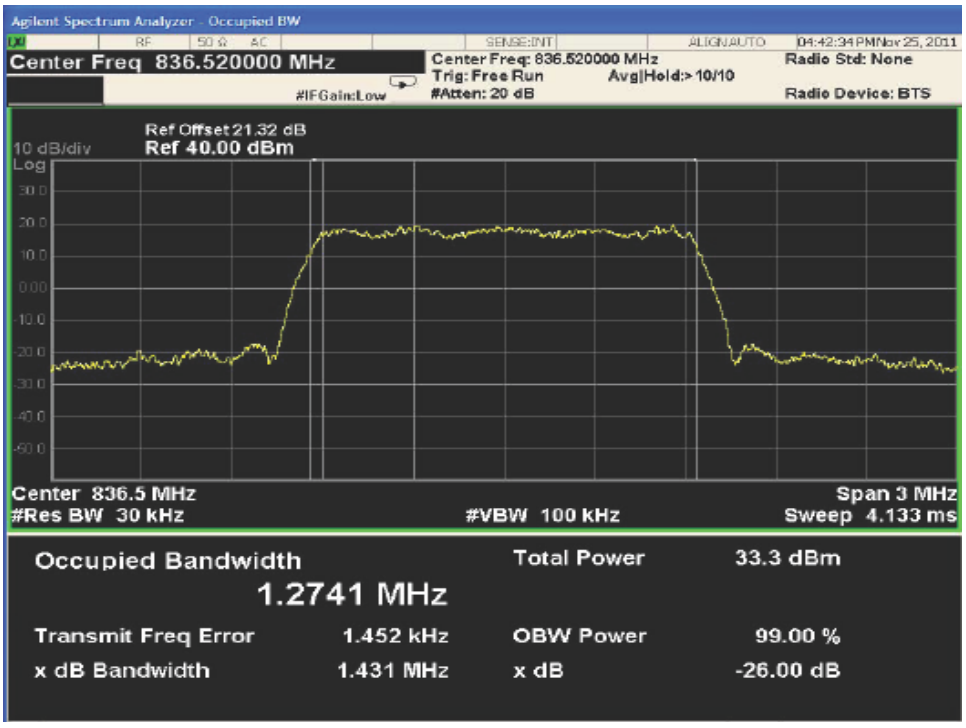
10. Test Plots (Cellular)

● Occupied Bandwidth / 26dB Bandwidth

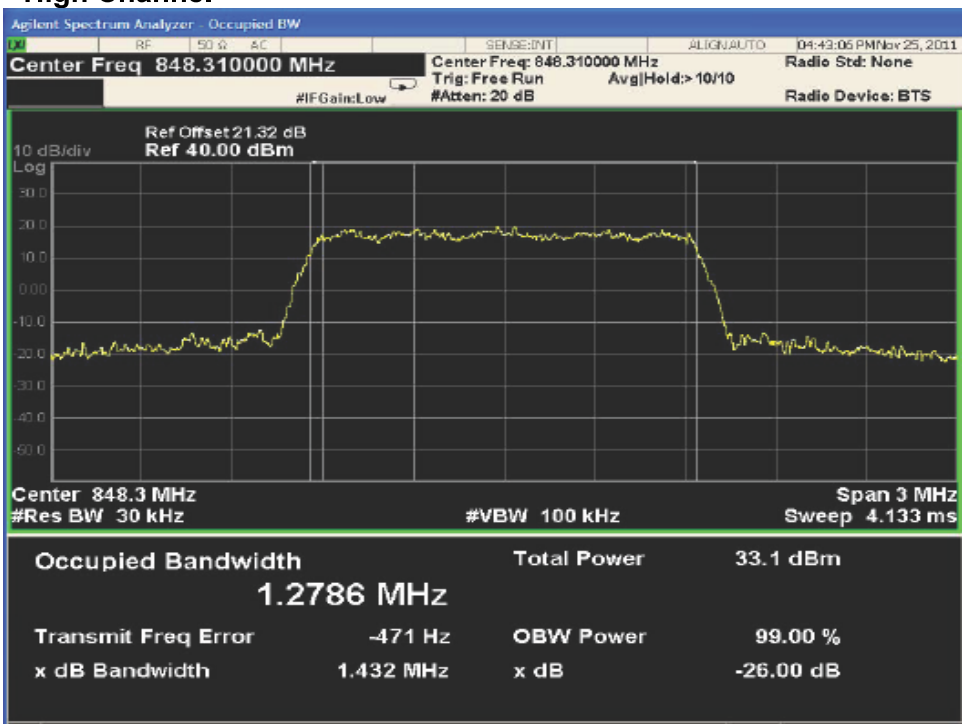
Low Channel



Middle Channel

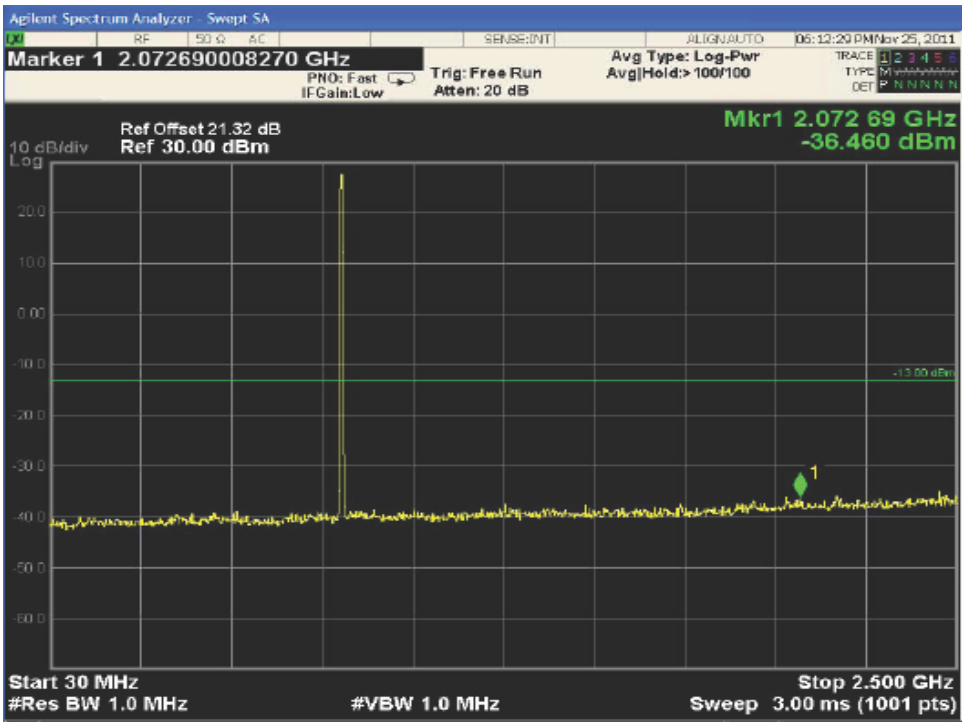


High Channel

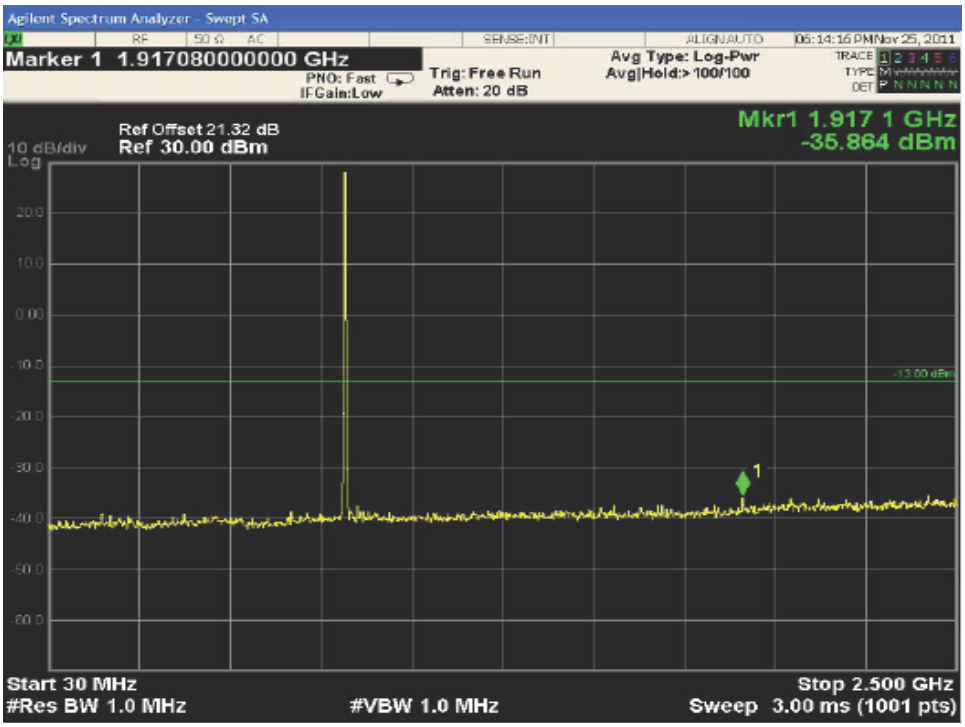


● Spurious Emission at antenna Terminals

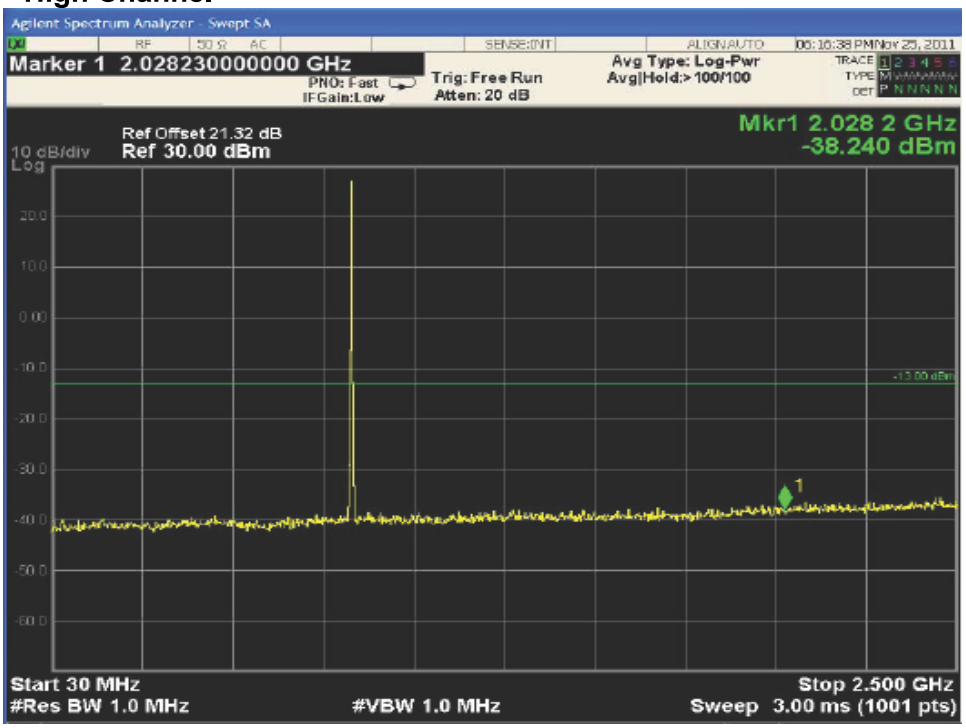
Low Channel



Middle Channel

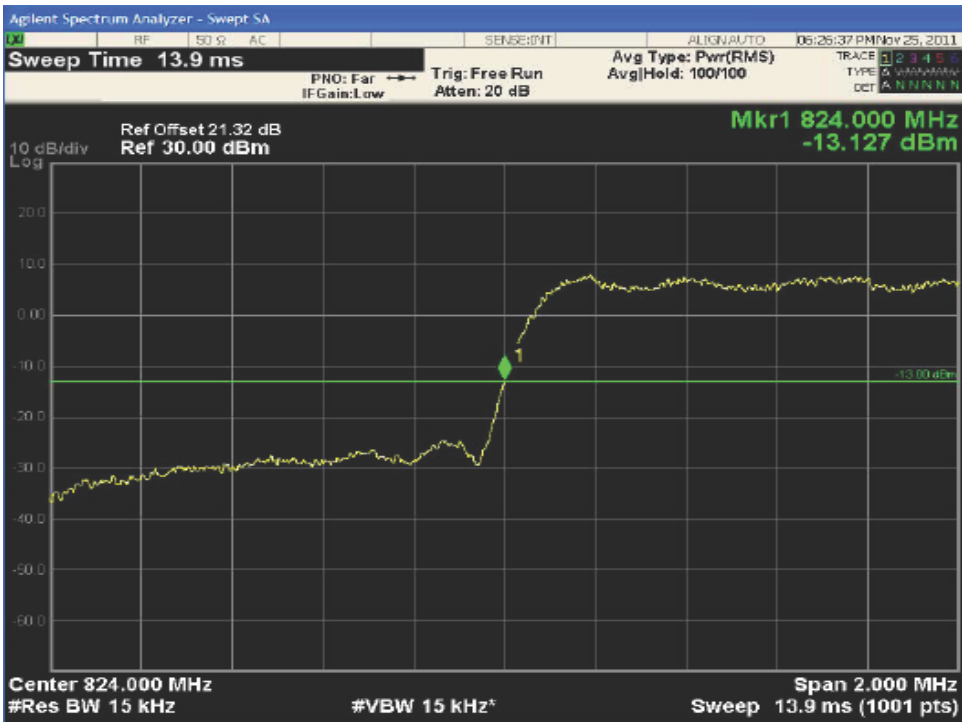


High Channel



● Band Edge

Low Channel



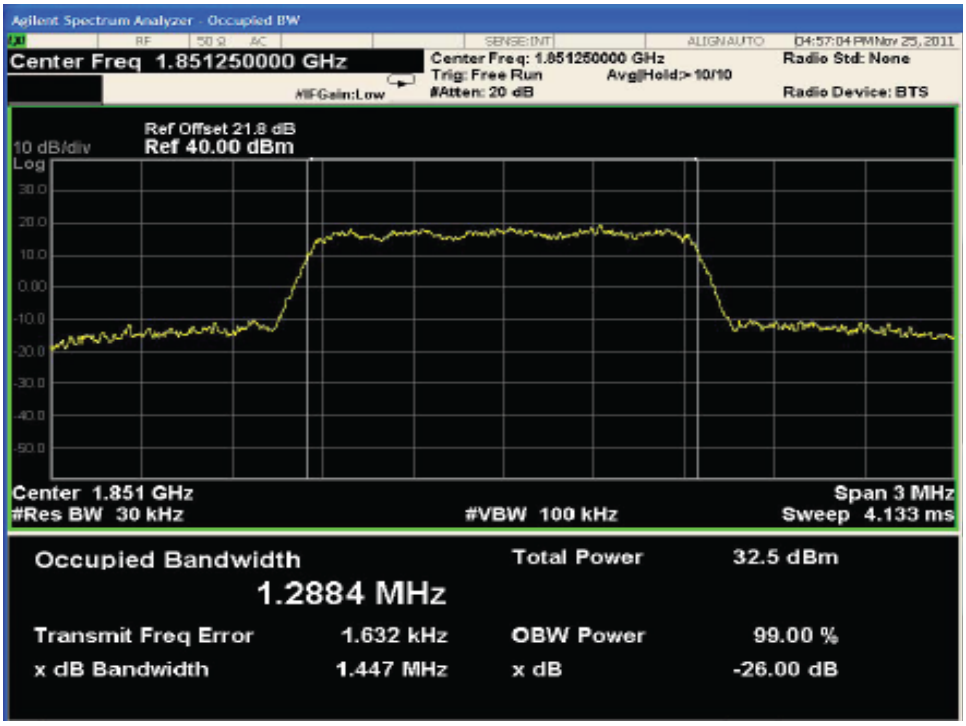
High Channel


Agilent Spectrum Analyzer - Swept SA
Marker 1 850.012000000 MHz
PNO: Far
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Pwr(RMS)
Avg|Hold: 100/100
08:38:47 PM Nov 25, 2011
Ref Offset 21.8 dB
10 dB/div
Ref 30.00 dBm
Log
Mkr1 850.012 MHz
-30.102 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-13.00 dBm
1
Center 852.000 MHz
#Res BW 100 kHz
#VBW 100 kHz*
Span 4.000 MHz
Sweep 1.00 ms (1001 pts)

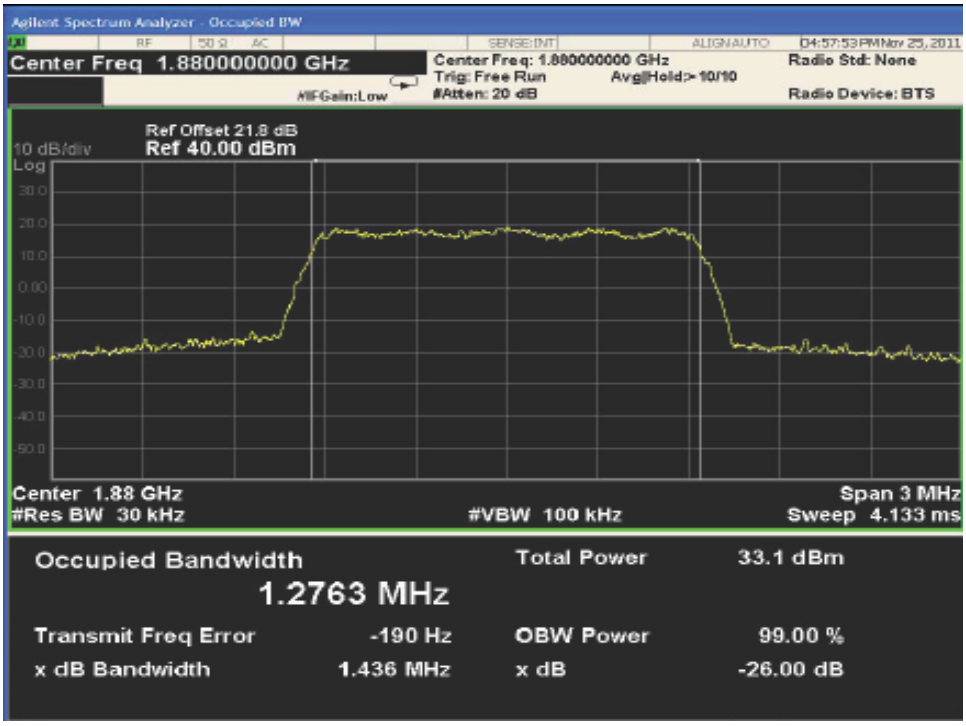
11. Test Plots (PCS)

● Occupied Bandwidth / 26dB Bandwidth

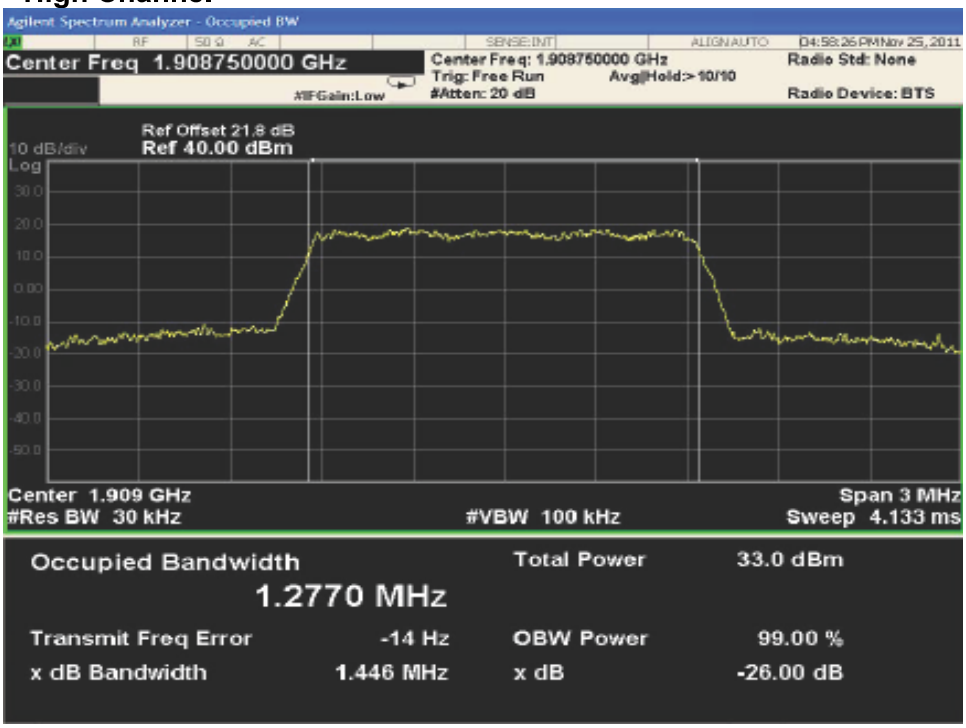
Low Channel



Middle Channel

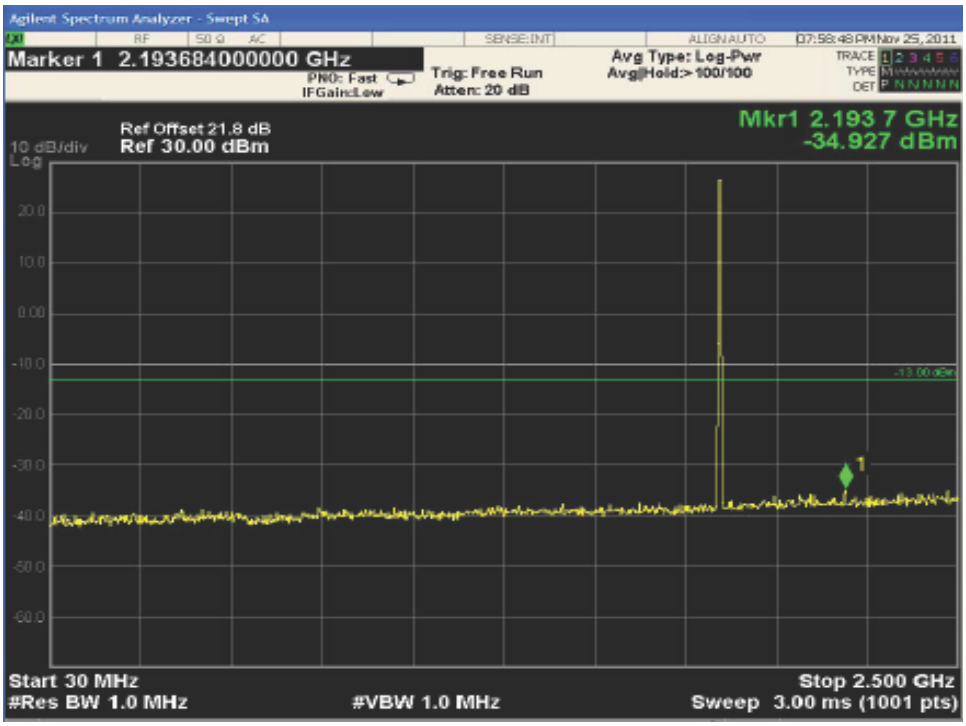


High Channel

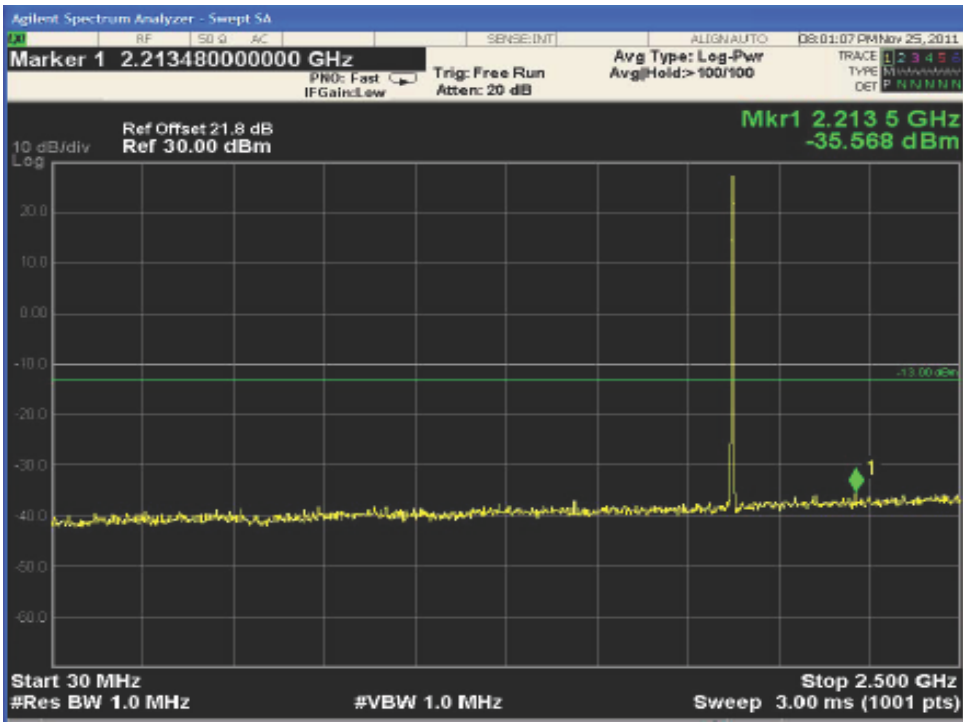


● Spurious Emission at antenna Terminals

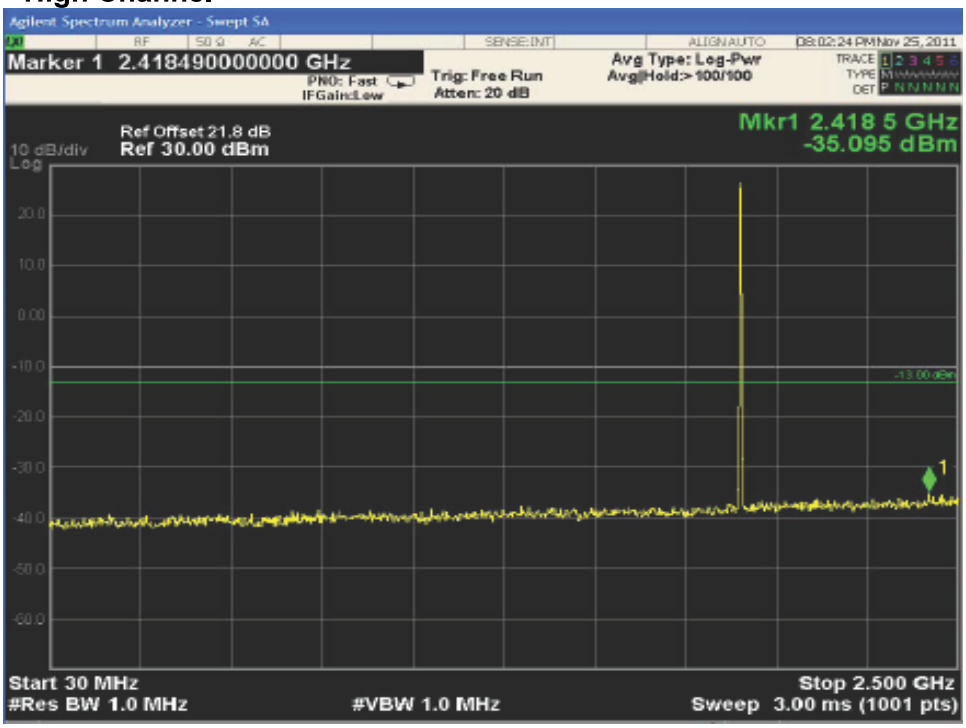
Low Channel



Middle Channel

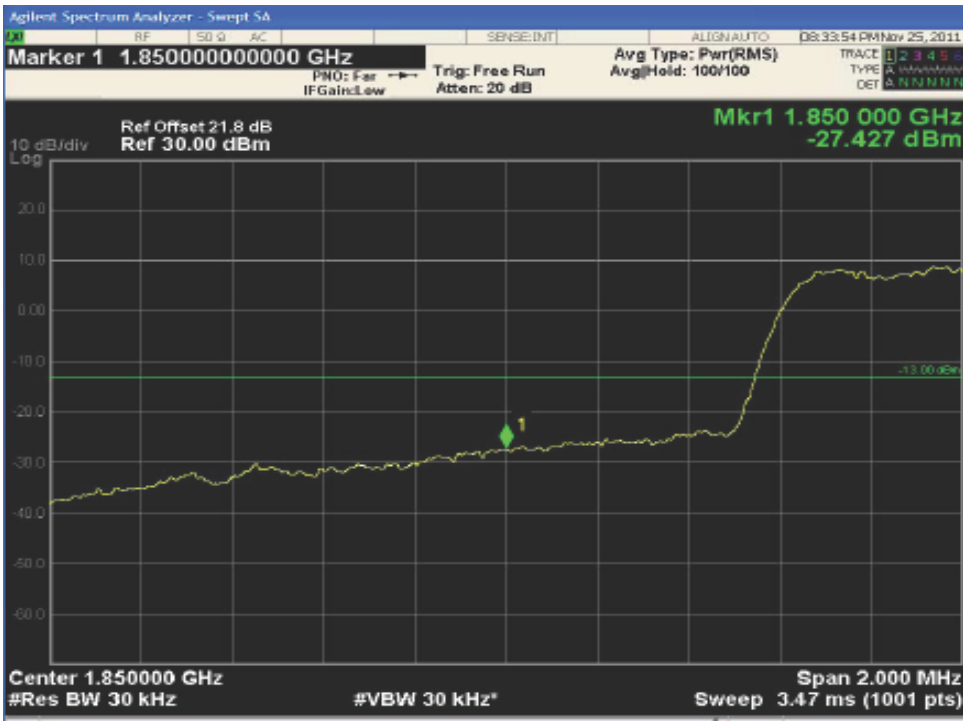


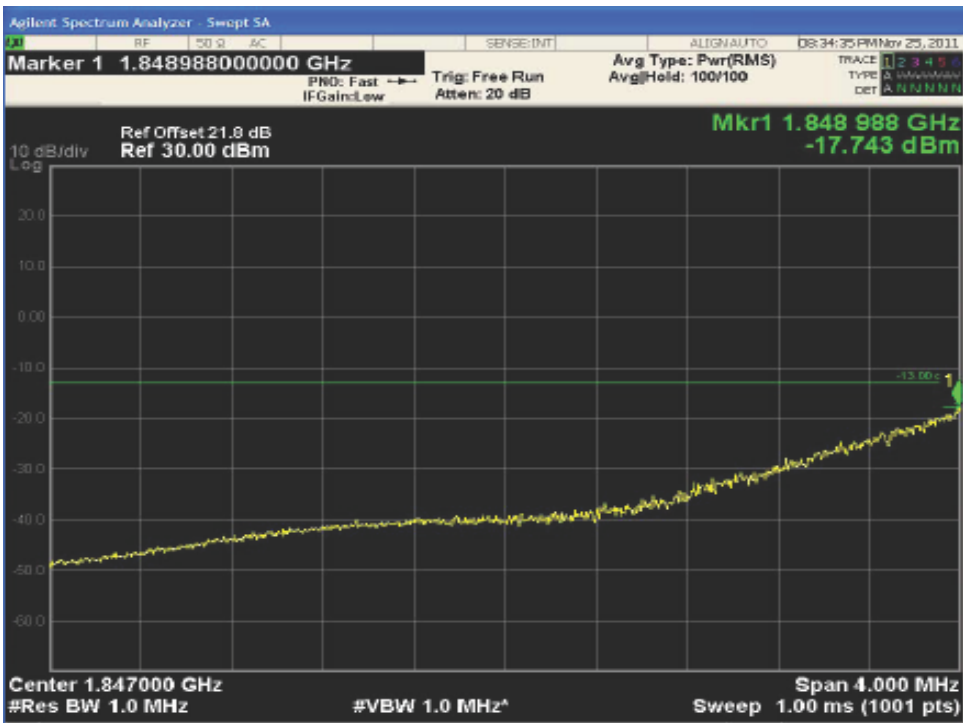
High Channel



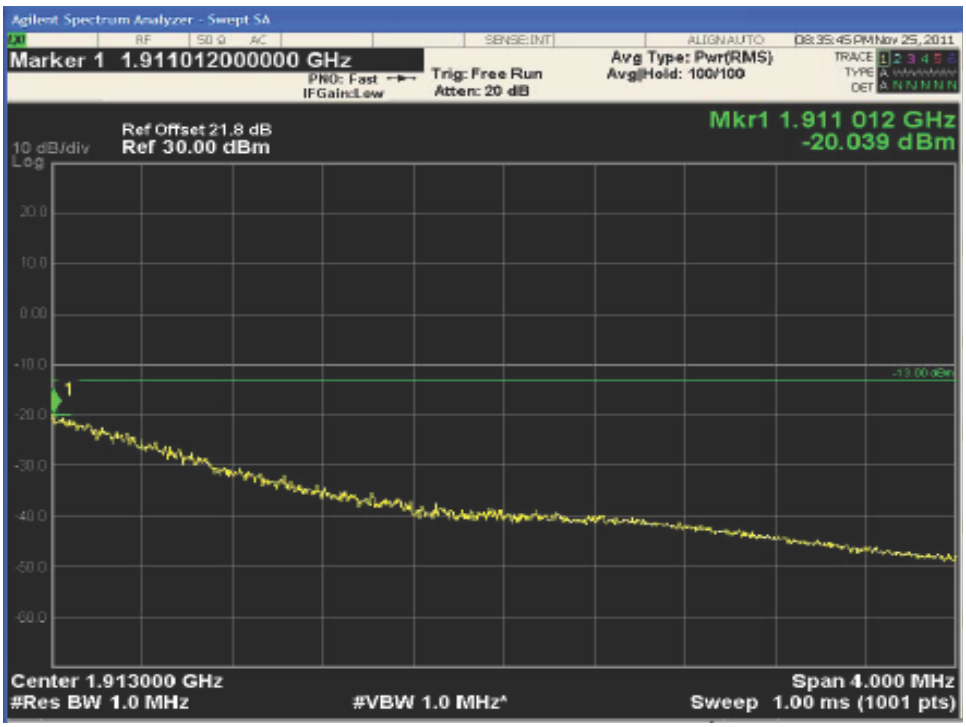
● Band Edge

Low Channel





High Channel


Agilent Spectrum Analyzer - Swept SA
Marker 1 1.911012000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Pwr(RMS)
Avg|Hold: 100/100
Ref Offset 21.8 dB
10 dB/div
Ref 30.00 dBm
Log
Mkr1 1.911 012 GHz
-20.039 dBm
Center 1.913000 GHz
#Res BW 1.0 MHz
#VBW 1.0 MHz^
Span 4.000 MHz
Sweep 1.00 ms (1001 pts)

12. Test Equipment List

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Jan. 14 2011	1 year
2	Test Receiver	R & S	ESCS 30	100302	Oct. 12 2011	1 year
3	*Amplifier	HP	8447F	2805A03427	Jul. 19 2011	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	Jul. 19 2011	1 year
5	*Amplifier	R & S	SCU-26	10011	Jun. 01 2011	1 year
6	*Pre Amplifier	HP	8449B	3008A00107	Jan. 13 2011	1 year
7	*Pre Amplifier	HP	8447F	2805A03351	Oct. 06 2011	1 year
8	*Wireless Communcation Test Set	Agilent	E5515C	MY48360948	Feb. 07 2011	1 year
9	*Signal Generator	R & S	SMP02	833286/003	Jul. 19 2011	1 year
10	*Spectrum Analyzer	R & S	N9020A	MY51110087	Jun. 03 2011	1 year
11	*Spectrum Analyzer	R & S	FSP40	100361	Jul. 19 2011	1 year
12	*Loop Antenna	EMCO	6502	8911-2436	Jan. 19 2010	2 year
13	*Biconical Log Antenna	ARA	LPB-2520/A	1180	Apr. 14 2010	2 year
14	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Dec. 24 2010	2 year
15	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-474	Jul. 14 2010	2 year
16	*Horn Antenna	Q-par Angus	QSH20S20	8179	Apr. 12 2010	2 year
17	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Apr. 14 2010	2 year
18	*Directional Coupler	HP	778D	15550	Jan. 13 2011	1 year
19	LISN	R & S	ESH3-Z5	833874/006	Oct. 12 2011	1 year
20	LISN	R & S	ESH2-Z5	100227	Apr. 06 2011	1 year
21	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
22	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
23	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
24	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
25	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
26	*Position Controller	Seo-Young EMC	N/A	N/A	N/A	N/A
27	*Turn Table	Seo-Young EMC	N/A	N/A	N/A	N/A
28	*Antenna Mast	Seo-Young EMC	N/A	N/A	N/A	N/A
29	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A